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The Wetness of Wales

Rainfall as a Factor in the Geography of Wales

J. OLIVER

PHYSICAL DETERMINISM IN GEOGRAPHY is often viewed with distrust. There is, however, a constant need to see that studies in regional geography are well based upon the physical qualities of the area with which they are concerned. This does not imply an undue bias towards certain elements of an area's make-up to the exclusion of other features, nor involve the necessity of finding the ultimate explanation of everything in terms of the physical environment.

Two qualities, among others, of the physical geography find frequent expression in the life and landscape of Wales: relief and climate. Wales is an upland rather than a mountainous land with much of its area more than 1000 feet above sea level and it experiences a cool temperate, western marginal, oceanic climate. Allowing for altitudinal modification mildness is one climatic characteristic, but more striking is wetness. Layman and specialist, inhabitant and visitor appreciate the significance of the magnitude and seasonal régime of precipitation over Wales. On the one hand Wales is blessed with an adequate supply of one of the necessities of domestic and industrial life, but on the other hand there are times when one could wish for a less abundant rainfall.

THE DISTRIBUTION AND NATURE OF PRECIPITATION

The detailed distribution of mean rainfall over Wales and Monmouth is shown on the Ordnance Survey ten-mile to one inch map for the period 1881–1915 and in the *Climatological Atlas of the British Isles*[1] for 1901–30. Fig. 1 has been drawn for the 1881–1915 period to emphasize the drier (i.e., under 40 inches p.a.) and wetter (i.e., over 60 inches p.a.) areas. The average rainfall for the whole country is 50 inches p.a. The peripheral nature of the drier parts is apparent. In this category are the coastal fringes of the Vales of Gwent and Glamorgan, the western extremities of the Gower and Pembrokeshire peninsulas, a narrow discontinuous belt around Cardigan Bay with parts of the Lleyn peninsula, much of Anglesey especially in the north and west, and the rain-shadow areas of northeast Wales and the Welsh Marches. Driest of all are the Vale of Clwyd and the coastal stretch about Rhyl and Prestatyn and the lower Dee and Severn valleys. In some years, e.g. 1955, 1945, 1941, 1933, 1921, totals below 20 inches have been recorded by some stations in these areas. The wetter areas are closely related

➤ Mr. Oliver is senior lecturer in geography at University College of Swansea. His paper was delivered at the Spring Conference of the Geographical Association at Aberystwyth on 10th April 1958. The area considered in this study includes Monmouth.

to the upland core of Wales especially on its windward, western, side. An elongated roughly rectangular area covering over one third of Wales with a projecting spur southwest to the Prescelly Hills and a larger south-eastern extension into the Brecon Beacons, the Black Mountains and the coalfield plateau has over 60 inches. In the east the rain-shadow effect offsets the altitudinal one. In Snowdonia over the period 1921–50 the mean rainfalls of Crib Goch (2340 feet O.D.) and Snowdon Delta (1435 feet O.D.) were 172·1 and 171·8 inches respectively, with over 200 inches in some wet years such as 1954 and 1928.

Mean values frequently conceal significant features of the climate. Water engineers in particular are interested in extreme values in given areas over periods of varying length, since they must design waterworks to meet such conditions. Areas with over 60 inches or under 40 inches correspond fairly closely with areas having over 225 or under 200 rain-days respectively. From this it can be seen that the upland rainfall intensity must be greater, even though the upland stations have a mean annual rainfall duration of over 1000 hours as against under 700 hours on the lowlands; thus we may compare Swansea, Victoria Park (28 feet O.D.) and Cray Reservoir (1044 feet O.D.) where the mean duration, 1921–50, was 663 and 1158 hours respectively. A surprising number of falls 2·5 inches or over on a rainfall day are recorded[2] over the upland counties. Such heavy falls are uncommon in the English lowlands. In the wet year of 1954 one third of 306 falls of such magnitude in the British Isles were recorded by Welsh stations whilst in South Wales on 23 November 1946, 38 stations recorded such a fall. Stations with a mean rainfall of 80–90 inches will probably experience on the average at least one day a year with a fall of 2·5 inches or more. Four such days are probable in the wetter northwest of Wales. A number of falls of over 6 inches are recorded but only one fall of over 8 inches is known from Wales. On 11 November 1929, 8·31 inches of rain fell in 18 hours, in association with a secondary depression, at Lluest Wen (Rhondda, Glamorgan), producing serious flooding downstream.[3] In eastern England heavy falls are usually of a convectional nature but in upland Wales frontal rain accentuated by orographic influences gives steady, heavy daily falls as well as large totals for periods of a few days or a month. Since the high totals are less unusual in the wetter Welsh areas they often have a less disastrous effect than the fewer but less expected heavy falls in drier parts of England. In Wales the wetter Snowdon stations produce the highest monthly totals. Individual months may exceed 30 inches, and at Llyn Llydaw No. 9 gauge an extreme value of 56·54 inches fell in October 1909. On occasions high totals are recorded when two wet months succeed each other, such as the fall of 61·70 inches at Crib Goch in October and November 1929.

Rainfall records do not reveal the frequency of occasions when the uplands are shrouded in damp mist or drizzle. Such conditions keep the ground surface damp and reduce evaporation. The uplands of the

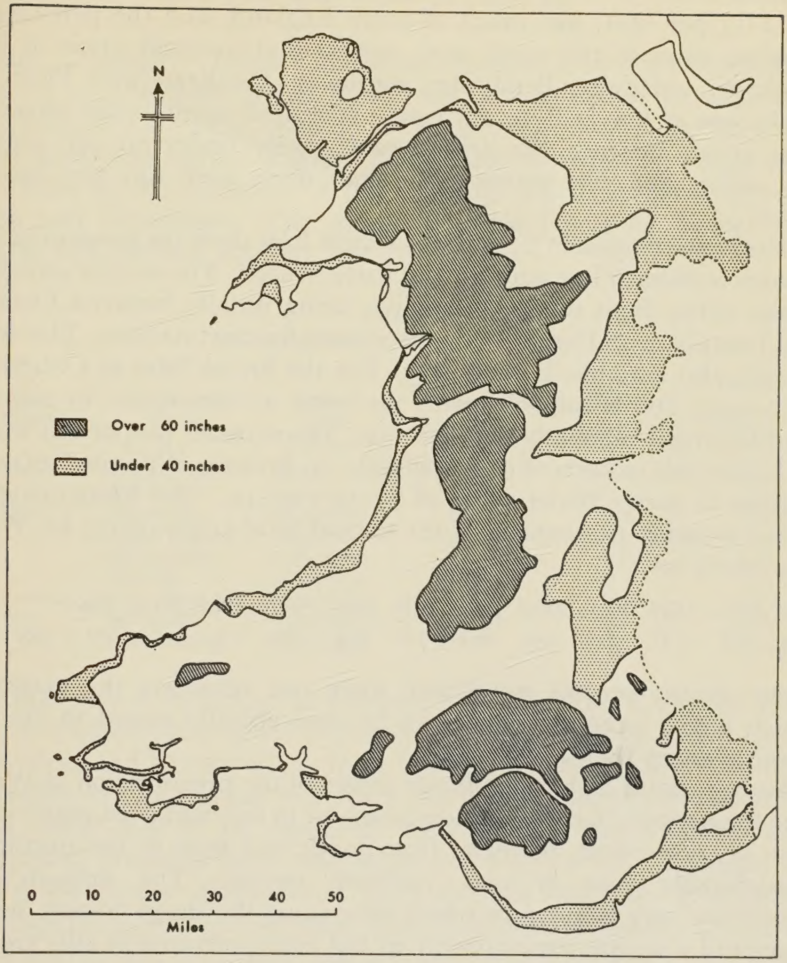

Fig. 1.—Wettest and driest areas of Wales according to mean rainfall values 1881–1915.

northern half of Wales have some 20 per cent less sunshine than the most favoured parts of Anglesey.

The variability of rainfall in time and space is important. Detailed rainfall maps, based on a reasonably adequate network of gauges, for Snowdonia[4] and the Elan and Claerwen catchment areas of the Birmingham Waterworks[5] show differences in rainfall of ten or more inches within a few miles. Rainfall records for hilly areas are difficult to obtain. Enclosed depressions and valleys within the uplands often share the same totals as the surrounding ridges. It is almost impossible to define a general quantitative relationship between rainfall and altitude.

S. Gregory[6] found for the period 1901–30 that the mean deviation of the rainfall expressed as a percentage of the average rainfall gave the highest values of 14–16 per cent in east central Wales, the uplands of Radnor and the Black Mountains. Most of Wales showed a variation of 12–14 per cent, like much of south England, and the percentages dropped towards the north and west so that in small areas in west Anglesey, northwest Pembroke, southwest Cardigan and Flint the figure was as low as 8–10 per cent. West and north Wales show the least range between the driest years (rarely under 70 per cent of the mean) and the wettest years (not often over 140 per cent of mean).

The western oceanic parts of the British Isles show the predominantly greater wetness of late autumn and early winter. The wettest month in Wales varies from station to station, being usually between October and January, with December as the wettest for most stations. The driest month, also variable, is often May. For the British Isles as a whole for 1870–1939 Dr. Glasspoole gives the ratio of the winter to summer months (April–September) as 56 : 44. The summer proportion would be higher still in parts of east England. G. Bransby-Williams[7] gives for stations in north Wales ratios of 57–59 : 43–41. The Meteorological Office monthly percentages of the annual total (1881–1915) for Wales as a whole are:

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
9·4	7·8	7·6	5·9	5·9	6·1	7·2	9·4	7·0	11·2	10·5	12·0	per cent

These details become significant when one considers the extent to which higher winter supplies can be economically stored to eke out lower summer totals.

Snow is not a highly significant aspect of the precipitation of Wales. The frequency of days with snow observed to fall, and even more of the days of snow cover, increases from south and west to the northeast. Considerable year to year variation occurs. The uplands can experience very heavy falls which may cause the sheep farmers severe losses and dislocate communications but heavy continuous falls are not so characteristic as in eastern parts of Britain which have no orographic shelter from the east. Heavy falls usually melt rapidly or turn to rain although the highest parts of Wales experience considerably increased frequencies of snow falling and lying.[8]

River catchments must be developed as a whole and adequate climatic and run-off surveys are a prerequisite of efficient water use. The difference between rainfall and water loss due to evapotranspiration and percolation, primarily the former in Wales, gives a measure of the water available from a given catchment area. The exact relationship between rainfall and run-off still needs more analysis. In the Elan valley the run-off was 53 per cent of the rainfall in the months April–September but 80 per cent of the rainfall in the winter months. For nine Welsh records examined the mean loss as a percentage of the average rainfall for the same period was 29·2 per cent, varying from 24·3 per cent for the Taf Fawr (Glamorgan) to 37·0 per cent for the

Brenig (Denbigh). Table I illustrates the run-off as determined for a number of gauges for which fairly long records exist.[9] Penman[10] on the basis of a formula relating air temperatures, sunshine duration, wind speed and vapour pressure determined the losses by evaporation for Wales as 17–19 inches, a large part of which occurred between April and September. The mean water-loss figure for Welsh flow-gauges with records 1937–55 was 18·8 inches.

Table I

RAINFALL AND RUN-OFF 1937–1955

River Board	*Gauging Station*	*National Grid Reference*	*Drainage area square miles*	*Mean water loss* 1937–55 *inches*	*Run-off as % of rainfall* 1937–55
Taff	Taf Fechan	32/060117	13·0	18·6	75·7
	Taf Fawr	32/012111	16·2	22·0	72·1
Wye	Rhayader	22/965678	64·4	17·8	71·6
	River Elan	22/927640	71·2	20·2	71·0
	River Irfon	22/892460	28·1	18·6	72·8
	Erwood	32/076445	495·0	16·1	69·3
Severn	Lake Vyrnwy	33/019191	36·4	18·9	74·9
Dee	Erbistock	33/357413	401·0	17·9	66·8
	River Brenig	23/974539	7·8	18·7	63·0

A difficulty of hydrological planning is a deficiency or uneven distribution of quantitative data. Fig. 2 shows the distribution of flow meters over Wales and Monmouth in 1957, but nearly half of these commenced operation only in the last two years. As well as uncertainty about the exact water loss to be expected, there is even more limited data concerning probable flood magnitude and frequency. The longer the record the greater likelihood of more extreme floods being recorded. The lack of knowledge is greatest and its seriousness most in the case of large catchment areas. The ratio of the extreme minimum to maximum daily mean flow is very variable. The lowest figures came from the Taf Fechan and Elan, in each case below reservoirs, where the ratios were respectively 1 : 61 and 1 : 166, whilst the small catchments of the Taf Fawr, at Llwynon reservoir, and the Brenig gave ratios of 1 : 796 and 1 : 513.

Examining the meteorological data geographically two approaches are adopted. Rainfall is considered as an environmental factor and also an economic resource.

RAINFALL AND THE PHYSICAL ENVIRONMENT

It is not necessary to discuss here the part that water plays in the evolution of the land forms of a humid climate. In a geomorphological region there will eventually develop a natural balance between the run-off and the density and forms of the valleys. Much of the Welsh landscape shows the imprint of periods of still stand during which plains of marine or sub-aerial origin were developed. From the resultant extensive surfaces of low relief, water drains less readily until it reaches the incised portions of the rejuvenated streams where the narrow valleys constrict the extent to which excessive floods can stretch but also increase the velocity of such flood water. The actual bed of the stream can cope fully with only $\frac{1}{3}$ to $\frac{1}{2}$ of the peak flow. The degree of flow variability and the width of flood plain are important. Extensive floods are not a frequent menace in Wales, except in the lowland courses of rivers having their sources in upland Wales notably the Severn, Wye, Usk, Towy and Teifi. Over the period 1862–1949 the Severn at Worcester exceeded bank-full conditions 126 times, showing a greater frequency since 1938 together with a more rapid rise and fall, possibly the result of drainage schemes on the uplands. Many of the Welsh rivers have a stream bed related to their larger winter flow and may reveal in dry periods expanses of gravel or boulders. Severe floods have nevertheless followed persistent heavy falls over large areas of a river catchment. Land drainage may accelerate the run-off from upland areas and thereby increase flood risks on the lowlands.[11] Peat when drained has less powers of water detention. The discharge decreases rapidly with the onset of a dry period but the run-off response to rainfall is more rapid. In some ways the steadier flow from undrained peat may be more desirable.

Changes in soils in Wales reflect rainfall contrasts. Where free drainage occurs soil leaching and the removal of soluble salts especially nitrates and bases are characteristic. Soil immaturity, soil profile truncation and reduced percolation on impermeable rocks explain why extensive areas of podsols are not found. Many soils are, however, podsolized and acid in reaction. Cultivated soils may suffer from surface compaction by heavy rain. Where drainage is impeded waterlogging results under heavy rainfall. Many upland areas have blue-grey gley soils, with indefinite horizons and sometimes rusty or yellowish mottling resulting from seasonal fluctuations in the degree of waterlogging. A half or more of the soils of Wales suffer from some degree of drainage impedance especially in winter. Even the brown earths of the drier, lower parts of Wales have a lower base status than the typical brown earths of eastern England. When waterlogging becomes excessive, bacterial breakdown of organic matter is reduced and peat accumulates. Extensive areas of acid, blanket peat bog on hill crests and gentler slopes are the result of the wet climate of the present and probably even more so are relics of the wet sub-Atlantic period (500–0 B.C.). So far as is known no map of the distribution of blanket peat has been published. It would make a valuable addition to our knowledge. On persistently waterlogged peat, cotton grass (*Eriophorum*) and deer sedge (*Scirpus*) moor of little grazing value develop. *Molinia* moor, on poorly drained areas of moderate peat cover, and *Nardus* on better drained peats offer some spring and early summer grazing. The peat areas of Britain offer one of the largest potential areas for improved utilization. They offer possibilities for

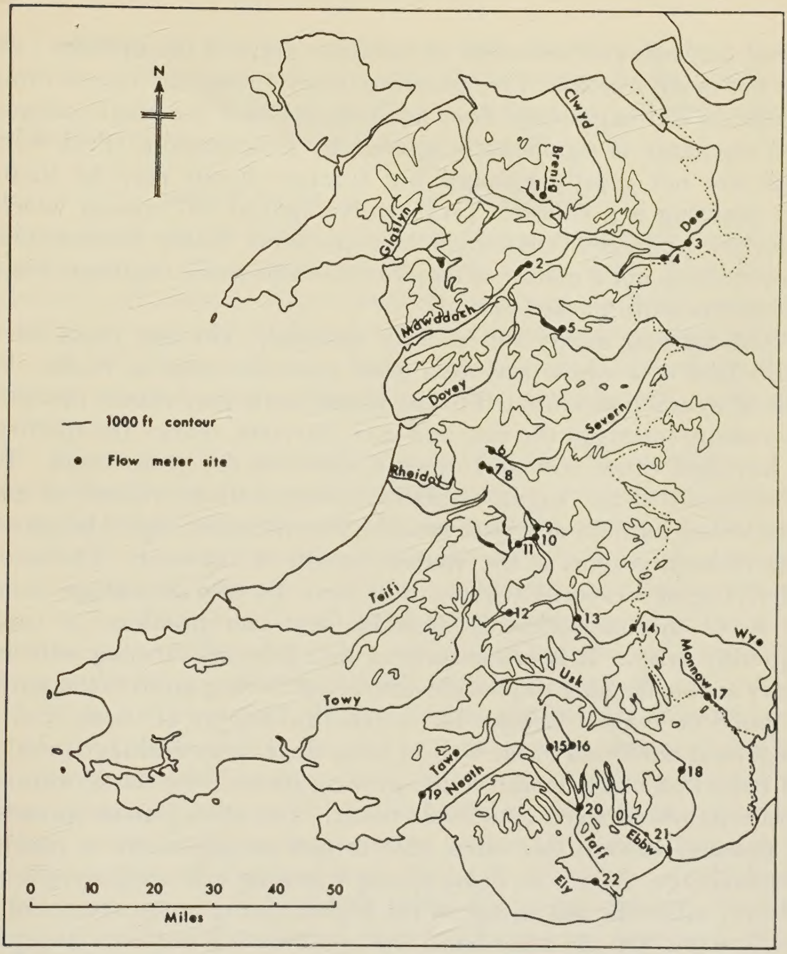

Fig. 2.—Location of flow meters installed by River Boards in Wales (1957).

1. River Brenig
2. River Dee (Bala)
3. River Dee (Erbistock)
4. River Ceiriog (Brynkinalt Weir)
5. Lake Vyrnwy
6. River Wye (Plynlimon Weir)
7. River Wye (Cefn Brwyn)
8. River Wye (Pant Mawr)
9. River Wye (Rhayader)
10. River Wye (Glyn Railway Bridge)
11. River Elan (Caban Coch Reservoir)
12. River Irfon (Abernant)
13. River Wye (Erwood)
14. River Wye (Hay)
15. Taf Fawr (Llwynon Reservoir)
16. Taf Fechan (Taf Fechan Reservoir)
17. River Monnow (Kentchurch)
18. River Usk (Chainbridge)
19. River Tawe (Morriston)
20. River Cynon (Abercynon)
21. River Ebbw (Rhiwderin)
22. River Ely (St. Fagans)

afforestation and experimental plantings on peat have been made in Beddgelert (Caernarvon) and Clocaenog (Denbigh) forests. The task is a difficult one and the results are not always encouraging economically.

Trees appear to be very flexible in their demands for or ability to withstand heavy rainfall. More important are the depth and drainage of the soil and the degree of exposure to winds and frost. These factors control successful afforestation in extensive areas of the uplands rather than too much rainfall. Tree planting may improve the rate of rainfall absorption but experience does not indicate that the total volume of flood discharge is significantly altered by afforestation. Peak winter floods are not greatly reduced but summer floods may be limited. Tree planting is a valuable preventative against soil erosion which is however less prevalent than might be expected in Wales. Sedimentation of reservoirs is not a matter of major concern to water engineers even in catchments with marked run-off.

Welsh farming rarely suffers from drought. The dry years for the British Isles as a whole are often good years for most of Wales. Wet spells of weather accentuated in the wetter parts may retard ploughing and sowing, interrupt the hay and corn harvests, reduce the quality of the hay and cause rust and other diseases in the grain crops. It is unfortunate that the August rainfall for many stations is nearly as much as the wetter autumn or winter months, in some cases, e.g., Aberystwyth (Gogerddan), August is the wettest month of the year. The second half of August is especially likely to be wet. To take advantage of short dry spells mechanization is desirable but the problem of capital frequently arises. It is not surprising that pastoral farming with subsidiary arable farming to provide additional feeding stuffs is the pattern for much of Wales. Grasses like a plentiful supply of water, but the best grass is not found in the wettest areas since there drainage problems and reduction of the length of the grazing season with deterioration of pasture in waterlogged conditions occur. Too often juncus spreads in the pastures though this often reflects bad management as much as poor drainage. Wet soils delay spring warming and seed germination and may offset the advantage of the higher spring temperatures of the oceanic west. On the other hand wet lands are less liable to late spring frosts.

Settlement in upland Wales reflects the negative qualities of the environment. Other than settlements dependent upon mining, quarrying or tourist activities, relatively few rural settlements occur above the 900-feet contour or the 60-inch isohyet. Wetness rather than relief or lowered temperatures is the drawback. As upland depopulation continues the avoidance of the wet, exposed uplands is accentuated. Much of the area showing a 5 per cent population decrease between 1931 and 1951 has over 60 inches of rainfall. Many other factors, some of a non-physical character, are involved in this process but, through its effect on farming, rainfall influences the settlement attractiveness of the upland areas. In the British Isles cereals and a variety of crops can grow and ripen favourably with rainfalls below 30 inches. Between 30 and 60 inches cereal growing, even oats, becomes more uncertain and pastures are likely to deteriorate with the multiplication of weeds and less nutritious grasses. Over 60 inches soil leaching, waterlogging and acidity give rise to much rough pasture or sub-marginal land. Artificial fertilization is difficult since leaching is likely to give the benefits only to the lowland farmer at the expense of the hill-farmer. The nature of the difficulties in the wet uplands is well illustrated by the Mid-Wales Investigation Report of 1955.[12]

RAINFALL AS AN ECONOMIC RESOURCE

There is a constant challenge to man's resourcefulness to make the optimum use of his natural environment. The water resources are imperfectly developed. Slow progress has been made in using this valuable raw material for industry and in meeting domestic and other demands in urban areas in Wales or adjacent parts of England. Abundant rainfall offers opportunities for water supply and power generation.

The Welsh woollen and early iron industries took advantage of the fairly steady flow of the incised streams as sources of power. Abundant coal in the northeast and southeast discouraged extensive subsequent exploitation of water power during the eighteenth and nineteenth century industrial expansion. More recently the growing demand for electricity has been met by coal-fired thermal stations. The remaining remnants of the woollen industry especially in Cardigan and Carmarthen still use some water power but diesel engines or electricity now provide much of the motive power. Hydro-electric generation is a more recent way of using water power but in the year 1956–7 only 0·17 per cent of the total electricity output for England and Wales was from this source. The installed capacity of the hydro-electric plants, 93 per cent of which are in Wales, amounts to 0·3 per cent of the total generating capacity (1957) of England and Wales.[13] The four small hydro-electric power plants of the South Wales Electricity Board were closed in 1955–6 and no future hydro-electric schemes are envisaged. North and central Wales offer greater opportunities in their abundant rainfall, natural storage lakes and bigger heads of water. Ffestiniog was one of the earliest hydro-electric plants in Britain. Fig. 3 gives the details of the main stations. In addition a minor supply of 82 kW capacity is still available at Dolgelly. The Towyn station was closed in 1954. The compensation water from the Elan and Claerwen reservoirs drives a small 300 kW capacity plant which supplies the needs of the water-works while the surplus goes to the South Wales Electricity Board. Some hydro-electricity is also generated from the Lake Vyrnwy outflow. The North Wales supply is fed via Wrexham into the Electricity Grid at Crewe as well as to the Oakley Quarries (Blaenau Ffestiniog) and to Dolgelly and Machynlleth.

Interesting new developments in hydro-electric generation are in progress, not without opposition in some quarters. A conventional hydro-electric scheme with a 59-square mile catchment in the Plynlimon area was sanctioned by the North Wales Hydro-Electric Power Act in 1955. Three reservoirs will store and regulate the flow of the Rheidol and its upper tributaries near Ponterwyd village. The plants of 49,000 kW capacity are to be in commission in 1961. A more ambitious project sanctioned by the same Act is the pumped storage scheme southwest of Blaenau Ffestiniog. This is the first of its kind in Britain and is believed to be the largest so far planned in the world. The Afon Ystradau will be dammed to form a large reservoir and the higher, natural Llyn Stwlan will be enlarged. During the peak hours water discharged through tunnels from Llyn Stwlan into the lower reservoir will drive turbines with a generating capacity of 300,000 kW. At off-peak hours in the night electricity from the grid will be used to pump water back to Llyn Stwlan. A 46-mile transmission line will be constructed to Connah's Quay (Flint). The plants will be in commission between 1961 and 1963. A scheme of 35,000 kW capacity at Ffestiniog and other schemes on the Mawddach, Conway, Nant Ffrancon and in Snowdonia have been shelved for the time being.

Recent forecasts have claimed that atomic electricity will be cheaper than conventional electricity by 1962 and half the cost by 1982. This would reduce the value of hydro-electric sites but emphasize the need for ample supplies of cooling water. Where estuarine water is not available the alternative source must be of considerable size. The atomic power station at Blaenau Ffestiniog (if it is established) will take advantage of the water of Trawsfynydd Lake, the temperature of which will be raised 10° F. by the 9-day cycle of re-use. Large-scale industrial location, such as the envisaged third steel strip mill which South Wales hopes to have, has to be examined in the light of available water supplies.

Recent discussions at the Royal Meteorological Society (November 1954)[14] and the Royal Geographical Society (March 1958) indicate increasing interest in the growing demand for water. Professor Balchin[15] has brought the matter to the attention of geographers. The forecast that the 1970 water needs would be twice those of 1938 seems likely to be confirmed if not exceeded.[16]

Within Wales and Monmouth the major water demands are from the industrial coalfield areas. The earlier and apparently liberally planned schemes have not been able to meet all the demands so that new resources further afield have had to be sought, such as Swansea's new reservoir on the Usk. On the whole, north and south Wales are well placed with moorland gathering grounds and with suitable incised valleys for water impounding. Taking England and Wales as a whole there is an obvious disharmony between the location of the main urban and industrial concentrations and the major overground water surplus areas. Four major water-using areas fringe eastern Wales; Bristol, London, the Midlands and Merseyside. Bristol meets its requirements from the Mendip area. The other three areas look towards the run-off of the Welsh hills, from which a large proportion

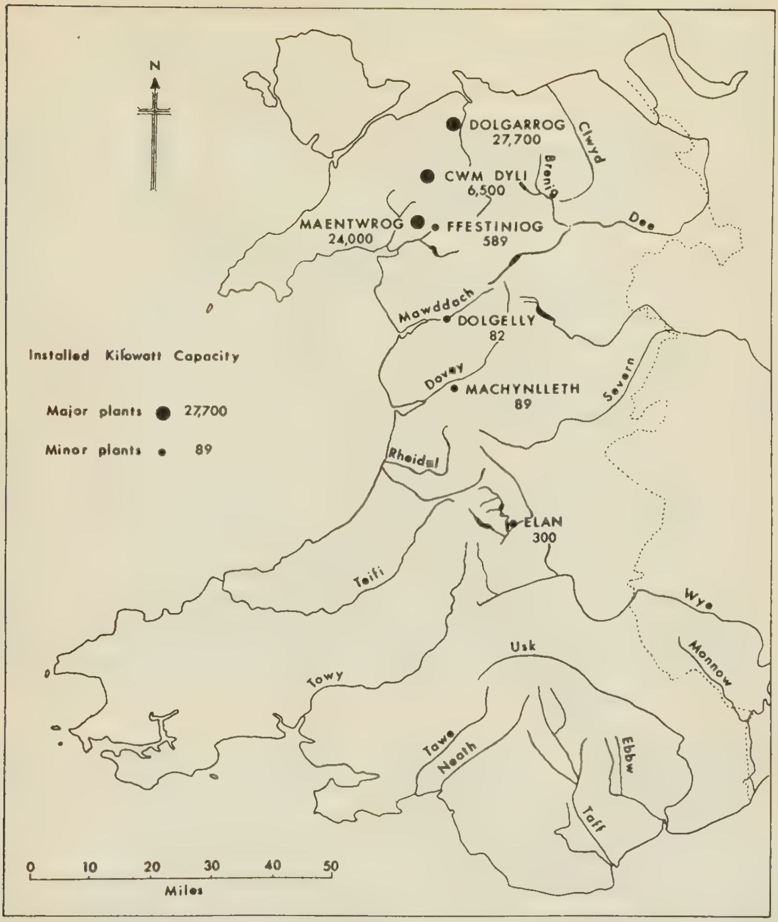

Fig. 3.—Hydro-electric power plants in Wales (1957) and details of main stations.

Station	*National Grid Reference*	*Catchment area square miles*	*Commencement of operation*	*Capacity kW*
Dolgarrog	23/770676	19·75	1907	27,700
Maentwrog	23/654395	22·0	1928	24,000
Cwm Dyli	23/653540	1·5	1906	6,500
Ffestiniog	23/694438	3·0	1900	589
Machynlleth	23/763004	17·5	1933	89

drains east by the Dee, Severn, Wye and Usk, for the solution of their difficulties. Not only is there a potentially large surplus of water but its quality is high as well. Birmingham, Liverpool and Birkenhead draw a considerable part of their needs from Wales. The Lake Vyrnwy scheme initiated in 1881 started to supply Liverpool in 1892 through a 68-mile aqueduct. A 73½-mile pipeline supplies Birmingham from the Elan and Claerwen reservoirs (Radnor). Gravity flow is possible in each case. Birkenhead draws water from the reservoirs on the Alwen (Denbigh). Much more could be done to utilize the available water. Liverpool has obtained Parliamentary acceptance for its water impounding scheme which is to flood part of the Tryweryn valley (Merioneth). Although consideration has been given since the start of the century to Wales as a supplier of water for London[17] so far nothing has been done to develop any of the suggested sources.

Whilst one cannot but feel sympathy for those dispossessed of lands which have been in their families for generations, a reasoned assessment seems to favour the extension of the function of Wales as a water supplier. The schemes require careful planning, detailed investigation of different alternatives and adequate safeguarding of local needs. It is significant that the Mid-Wales Investigation Report, on which Welsh interests were represented, suggests for the part of upland Wales studied, a greater use of land under three categories: extensive grazing, forestry and water catchment. "We consider that some of the upland moorland could with advantage be used for water conservation (domestic and industrial). This would be of general benefit to the local community, strengthen rural economy and avoid the use of better land at lower levels for the purpose." This use together with forestry could help to stem rural depopulation.

The importance of high rainfall and surface run-off is especially significant in Wales since the majority of the Lower Palaeozoic rocks are impermeable. There are few limestone or other water-bearing rocks to provide supplementary sources of underground water. Only half of the Welsh water boards derive water from springs and wells and this is but a small part of their total supply.[18] There is little opportunity in Wales for "aquifer recharge", i.e., the diversion of flood or winter excess water into porous underground rocks. Reservoir construction in the South Wales coalfield is, however, complicated by problems of watertightness.

Other demands on Welsh water, e.g., for navigation or for irrigation, are not significant. Water deficiency years are too infrequent for irrigation to be an economic proposition as it is in southeast England,[19, 20] except in drier areas such as Pembrokeshire and the northeast coast of Wales. A few horticulturalists have, however, already introduced irrigation in parts of Pembrokeshire.

Wales is more likely to benefit than suffer from the export of her surplus water. It is time that there should be a full acceptance of the fact that water is an asset in need of planned development. Full water use involves many and often conflicting requirements, yet when all these have been balanced there remains water going to waste which could be used for water-short areas. Just how much goes to waste is not accurately known. In the uplands, outside the reservoired areas, there are insufficient rain-gauges to give an accurate estimate, even within millions of gallons, of the available water. An approximate estimate for undeveloped Welsh gathering grounds is some 700 million gallons per day, enough for 15 million people.

REFERENCES

[1] Meteorological Office, *Climatological Atlas of the British Isles*, M.O. 488, H.M.S.O., 1952.
[2] Meteorological Office, *British Rainfall*, Annual volumes, Part I, Section 7.
[3] Meteorological Office, *British Rainfall*, 1929, pp. 74–77.
[4] G. Bransby-Williams, "Some characteristics of mountain rainfall illustrated in north-west Wales," *Water and Water Engineering*, vol. 58, 1954, p. 299.
[5] C. A. Risbridger, "Rainfall, run-off and storage: Elan and Claerwen Gathering Grounds," *Proc. Inst. of Civil Engineers*, part III, vol. 3, 1954, p. 345.
[6] S. Gregory, "Some aspects of the variability of annual rainfall over the British Isles for the standard period 1901–30," *Quart. Journ. Roy. Met. Soc.*, vol. 81, 1955, p. 257.
[7] G. Bransby-Williams, *op. cit.*
[8] G. Manley, "Snowfall in the British Isles," *Met. Mag.*, vol. 75, 1940, p. 41, and "Snow cover in the British Isles," *Met. Mag.*, vol. 76, 1947, p. 28.
[9] *Surface Water Yearbooks.* H.M.S.O. 1937–45, 1945–53, 1953–4, 1954–5.
[10] H. L. Penman, "Evaporation over the British Isles," *Quart. Journ. Roy. Met. Soc.*, vol. 76, 1950, p. 372.
[11] *Land Drainage in England and Wales*, H.M.S.O., 1951.
[12] *Mid-Wales Investigation Report*, Cmd 9631, H.M.S.O., 1955.
[13] *Reports of the Central Electricity Authority*, 1–9, 1948–57.
[14] Discussion on "Water Supply," *Quart. Journ. Roy. Met. Soc.*, vol. 81, 1955, p. 266.
[15] W. G. V. Balchin, "The nation's water supply," *Geography*, vol. 42, 1957, p. 149.
[16] P.E.P., *Policy for Water*, P.E.P., vol. 24, no. 418, Jan. 1958.
[17] R. C. S. Walters, *The Nation's Water Supply*, London, 1936.
[18] *Water Engineer's Handbook*, London, 1957.
[19] G. M. Howe, "The moisture balance in England and Wales," *Weather*, vol. 11, 1956, p. 74.
[20] *Weather and the Land*, Bulletin 165 of the Min. of Agric., Fisheries and Food, H.M.S.O., 1955, Fig. 9.

Population Movements in the West Midlands 1841–1861

R. LAWTON

THE PERIOD 1841 TO 1861 is significant in the demographic history of nineteenth-century Britain. In 1841 the census of population, hitherto under the supervision of the Overseer of the Poor, was first conducted by the Registrar General. The censuses prior to 1841 had consisted of little more than enumerations of the people. The 1841 census was on a much more ambitious scale and contained information relating to population structure, occupations and birthplaces. Moreover, vital statistics were by then being systematically and compulsorily recorded under the Civil Registration Act of 1837. It was therefore possible for the first time to calculate the relative importance of natural change (i.e. the balance between births and deaths) and migration in determining population trends in Britain. This was and is of considerable value for a period when population was growing rapidly and, more significantly, with wide variations in the rates of growth in different parts of the country, often as the result of population migration. Indeed, the statistical analysis of internal population movements in Britain is possible only from 1841;[1] prior to this the evidence was qualitative rather than quantitative and was based largely on sources other than the census of population.

Relatively little attention has been given to the statistical data concerning population movement in the censuses of population from 1841. Valuable though Professor Redford's conclusions[2] concerning the nature and causes of population movement may be, before its effects on population trends in nineteenth-century Britain can be appreciated, the census data on birthplaces and population movements must be analysed. A pioneer attempt by Ravenstein to formulate "laws of migration"[3] as he called them has not been followed up in detail. A notable exception is Professor H. C. Darby's paper on migration to and from Cambridgeshire, in which the census birthplace data for 1851 and 1861 are examined in some detail.[4] More recently C. T. Smith has used the enumerators' footnotes in the censuses of 1851 and 1861 to reach a qualitative assessment of the main areas of loss and gain by migration in England and Wales.[5] Much remains to be done, however, in analysing the role of migration in the development of the pattern of population distribution in nineteenth-century

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Britain. It is with this theme in relation to the West Midlands counties of Stafford, Warwick and Worcester for the period 1841 to 1861 that this paper is concerned.

Prior to the eighteenth century the areas of greatest population density in the West Midlands were in the more fertile agricultural lowlands. Here were located the chief towns, Stafford, Lichfield, Warwick, Coventry and Worcester. The coalfields of the Potteries, the Black Country and Cannock Chase were then little developed and industry, though of importance, was on a small scale. By the middle of the nineteenth century, however, the population was concentrated in the industrial areas of Birmingham and the Black Country and the Potteries, with lesser concentrations in Coventry and the East Warwickshire coalfield. Moreover, there had been a very rapid absolute increase in the population of the area. The following table, based on Gonner's estimates[6] (columns 2, 3, 6 and 7) and the Censuses of Population, shows the population changes in the West Midlands between 1700 and 1851 as compared with England.

Table I

	Totals				*Percentage Change*		
	1700	1750	1801	1851	1700–1750	1750–1801	1801–1851
England	5,518,613	5,733,132	8,345,519	16,915,825	3·9	45·5	102·7
Stafford	125,856	151,051	242,693	608,716	20·0	60·7	150·8
Warwick	98,725	134,070	206,796	475,013	35·9	54·2	129·7
Worcester	104,130	102,910	146,441	276,926	—1·7	42·3	89·1

Within the West Midlands the population in industrial areas was growing much more rapidly than in rural areas. The drift of population from country to town was frequently referred to by contemporary writers and was particularly active in the Black Country and Birmingham, to which people were attracted from the whole of the West Midlands and from farther afield.[7]

In 1841 returns were made of birthplaces of the population of each civil parish on the following basis: those born in the county in which the parish was situated; those born outside that county. In addition a sixfold tabulation of birthplaces was made for each hundred and borough: (*a*) born inside the county; (*b*) born outside that county (i) in the rest of England and Wales, (ii) in Scotland, (iii) in Ireland, (iv) in the Colonies, (v) in foreign countries.

From this data the scale of internal migration for the whole of Britain can be mapped on a parish basis. The pattern of total population density for 1841 (Fig. 1) shows three major concentrations: the Black Country and Birmingham, the Potteries and the East Warwickshire coalfield and Coventry, which shade outwards into lesser densities

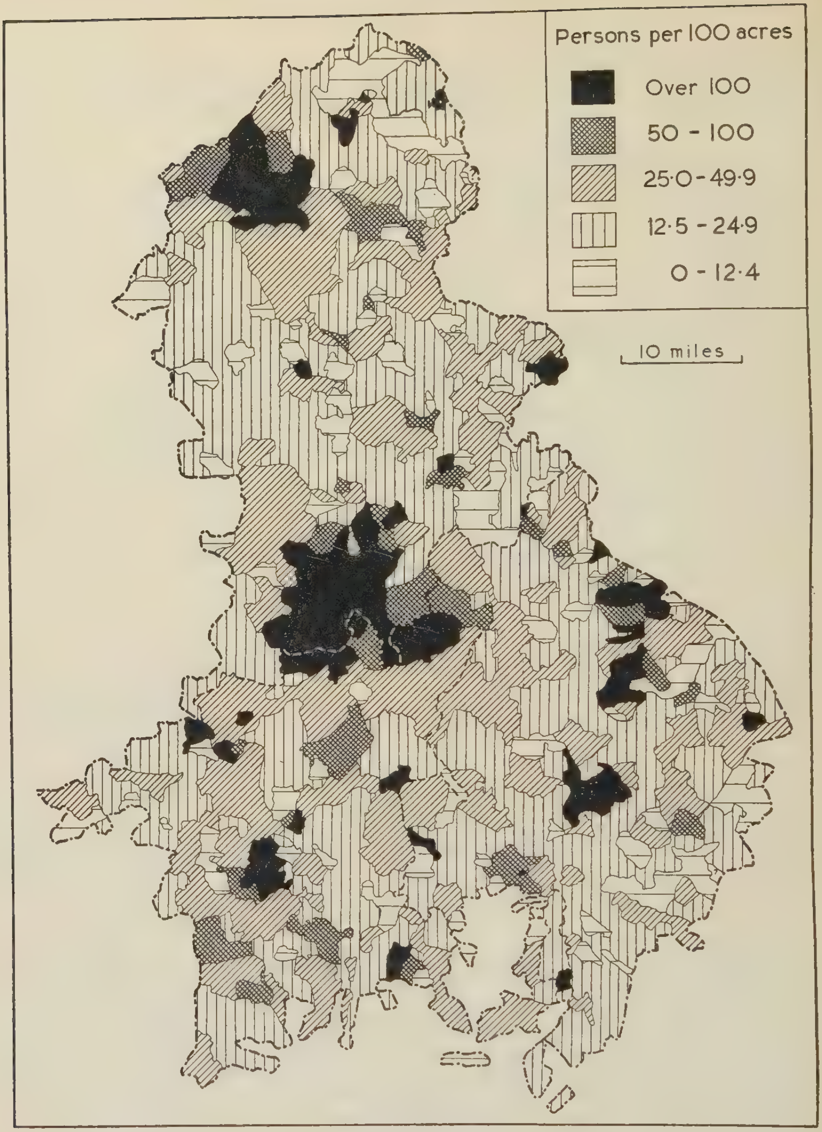

Fig. 1.—Population density 1841. Persons per 100 acres are calculated for each township in the West Midlands. County boundaries are shown by a pecked line. (Based on the enumeration tables of the Census of Great Britain, 1841).

in the predominantly agricultural areas. A number of smaller towns, of local rather than regional significance, stand out; they include older urban centres (e.g. the county towns and market centres like Stone, Stratford, and Shipston), two spa towns of late eighteenth and early nineteenth century development (Malvern and Leamington) and smaller industrial centres like Leek, Burton and Redditch. Rural population

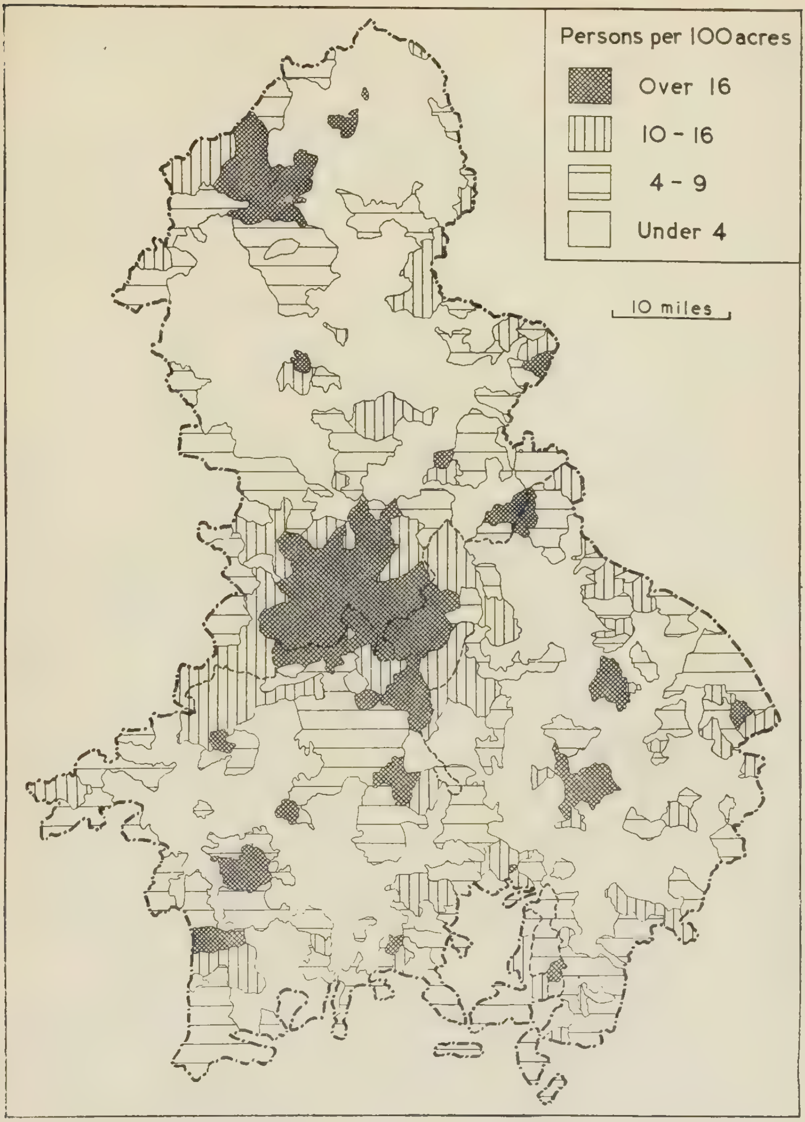

Fig. 2.—Inmigration up to 1841. The choropleths show for each township the density of persons born outside the county in which they were enumerated. County boundaries are shown in pecked lines. (Based on the birthplace tables of the Census of Great Britain, 1841.)

densities were high as compared with those of many agricultural districts of lowland Britain, with the highest densities in the mainly arable areas of the Severn and lower Avon valleys. No doubt at this time, as later, the farming of the West Midlands as a whole "derived encouragement from the large population of Birmingham and other considerable towns".[8] Such encouragement may well have influenced favourably the density of rural population. Agricultural wages were higher near the manufacturing districts of the West Midlands than in purely farming areas.[9]

The intensity of migration into townships up to 1841 measured by density (Fig. 2) closely resembled that of population density as a whole. It was focused in both extent and magnitude on the main centres of population, particularly the Black Country and Birmingham, the Potteries and, to a lesser extent, East Warwickshire. But every town tended to have more immigrants than its surrounding countryside. Rural townships had fewest immigrants. Nevertheless, they display features which indirectly shed light on the character of population movement. The rural townships with the greatest density of immigrants lay, in the main, along county boundaries. Most of the immigrants in these parishes were probably people who had come only a short distance over the county boundary from neighbouring rural areas. Such short-range movements would be more significant in 1841 than later in the nineteenth century when transport became better developed and were part of the "complex, wave-like motion" to which Redford likened much population movement in early nineteenth-century England.[10] Certainly much movement into manufacturing towns in the West Midlands between the late eighteenth century and 1841 was from nearby rural areas. In 1794 Wedge commented on the movement of population from rural Warwickshire into "Birmingham, Coventry and other manufacturing towns".[11] Matthew Bolton, founder of the famous Soho works at Smethwick, claimed that "I have trained up many, and am training up more, plain country lads into good workmen".[12] According to William Hutton, the historian of Birmingham, "Birmingham is a market everlastingly open for this kind of traffic". Similarly it was reported to the Midland Mining Commission of 1843 that much of the labour for the South Staffordshire Collieries was recruited from nearby agricultural areas.[13]

This drift of population from rural areas into nearby industrial areas continued between 1841 and 1861. During each of these decades population increases of over 20 per cent were restricted to a few registration districts in the Potteries and the Birmingham–Black Country area, while decreases of population occurred in rural districts adjacent to Birmingham from 1841 to 1851 and in a number of rural areas between 1851 and 1861 (see Fig. 3). The figures of net migration first available in the Census for the decade 1851 to 1861 stress the loss of population by migration from most rural districts in the West Midlands.* With two exceptions, the rapidly growing Burton-on-Trent and Upton-on-Severn districts (the latter including the growing resort of Malvern), inward movement predominated only in the Black Country–Birmingham area and the Potteries. Growth of the industrial centres and the inability of rural townships to absorb the natural increase in population jointly encouraged the process. In the mid-nineteenth century, casual agricultural labour at hay-making and harvesting was often Irish,[14] and by 1869 Evershed could write of an "occasional scarcity of labourers" in rural areas of Staffordshire.[15]

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* The net migration represents the difference between the natural intercensal growth of population (i.e. births minus deaths) and total population growth.

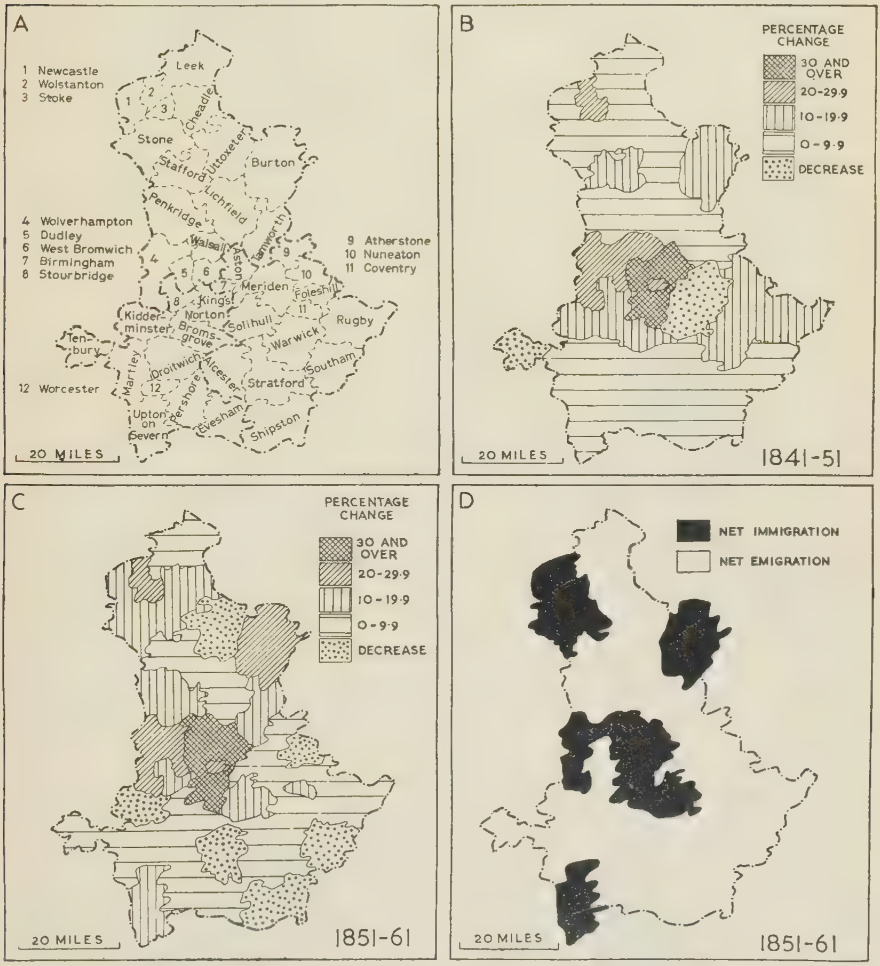

Fig. 3.—Population trends 1841–61. On the basis of Registration Districts (A) are shown percentage population changes 1841–51 (B) and 1851–61 (C), and net migration 1851–61 (D).

However, recruitment of surplus labour from nearby rural areas could not alone account for the very rapid growth of towns at this time. The birthplace tables of the censuses of population for 1851 and 1861 can be used to study patterns of population movement into and from the counties of England and Wales. Both censuses give the civil or geographical county of birth for the inhabitants of the registration districts of England and Wales, and migrants from Scotland, Ireland and the Colonies and foreign countries are separately classified. For 1861 additional summary tables show birthplaces for individual civil counties on the same basis. Thus, two types of map may be constructed: (*a*) the emigration of population from each geographical county into the registration districts of England and Wales, with the exception of those districts which overlap the boundaries of adjacent geographical counties;* (*b*) the geographical county of origin of immigrants into individual registration districts. It is possible from this material to show movement into counties or, by combining the information, into groups of registration districts.

Fig. 4 A, B and C shows the birthplaces of the population of each West Midland county for 1861. The choropleths show the numbers of people per 10,000 acres of the county of origin and thus the pattern of relative intensity of immigration. In 1861 each county showed mostly short-range inward movement, diminishing in intensity away from the county. This is of the type which Ravenstein and Redford judged to predominate in mid-nineteenth-century England. There are, of course, some distinctive individual features. Thus, the position of the Black Country–Birmingham area astride the boundaries between the West Midland counties further stresses short-range interchange of population. The only long-distance movement of importance was from London, though this was largely overshadowed by a considerably larger movement towards the capital, part of a countrywide pattern of migration focusing on London at this period.[16] There were, however, differences in the range of counties from which Worcester, a largely rural county, and Warwickshire and Staffordshire drew migrants. The two latter attracted many more people from farther afield. The counties with the greatest attraction for immigrants were those with the largest industrial populations.

By combining birthplace data for individual registration districts it is possible to map movement into specific regions within the West Midlands and to assess the importance of such movements in the migration into the West Midlands as a whole. Three such regions have been selected to illustrate variations in the pattern of immigration up to 1861: the Black Country–Birmingham region; the Potteries; and East Warwickshire and Coventry (Fig. 4 D, E and F). Choropleths plot the number of immigrants per 10,000 acres of the area of enumeration and are thus not directly comparable with Fig. 4 A, B and C.

The Black Country–Birmingham region includes the registration districts of Wolverhampton, Walsall, West Bromwich, Stourbridge,

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* There are two county units used in the censuses of 1851 and 1861. The civil county is the ancient or geographical unit. In addition there is a registration county consisting of groups of registration districts approximating to the civil county, but with some inevitable overlap where a registration district includes parishes in more than one civil county. See H. C. Darby, *op. cit.*, p. 119, for a full discussion of this problem. Such districts are indicated in Fig. 6 by a query.

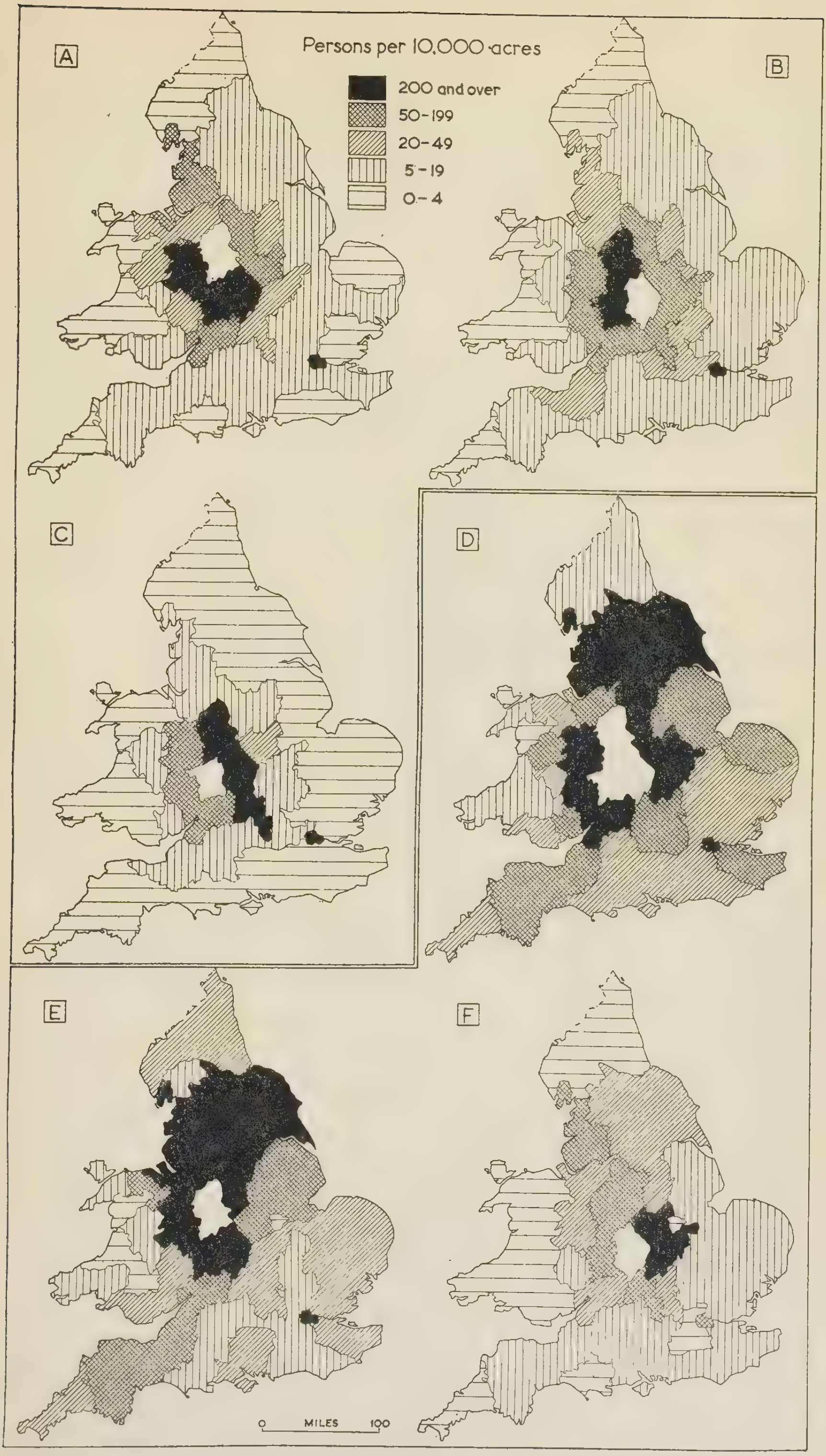

Fig. 4.—Immigration into Staffordshire (A), Warwickshire (B), and Worcestershire (C), up to 1861. The choropleths show the numbers of immigrants per 10,000 acres of their county of birth. This and all following figures are based on the birthplace tables of the Census of England and Wales, 1861.

Immigration into the Black Country and Birmingham (D), the Potteries (E), and East Warwickshire (F), up to 1861. The choropleths show the numbers of immigrants per 10,000 acres of the areas of enumeration.

King's Norton, Birmingham and Aston, which approximates closely to the Black Country region of 1861 as defined by G. C. Allen.[17] There was a high intensity of migration not only from all adjacent counties but also from Lancashire and Yorkshire in particular. The Black Country–Birmingham region did not take proportionately more of the immigrants into the West Midlands than it did of the total population (see Table II), having 51·6 per cent of the total population as against 51·1 per cent of the immigrants. But where long-range movement was concerned, for example from much of Wales, from East Anglia, and from London, the proportions going to Birmingham and the Black Country were much higher (see also Fig. 5). A twofold character of population movement into the Black Country–Birmingham region is thus suggested. On the other hand, there was a large short-range drift of population, in part between different parts of the Black Country, in part from adjacent areas, which is reflected in the high proportion of the immigrants who were born in Stafford, Warwick, Worcester and Shropshire. On the other hand, there were significant long-range movements from other areas, especially London, Lancashire and Yorkshire with their large urban and industrial populations.

Table II

	Population in 1861	Immigrants		Percentage of West Midlands population in 1861	Percentage of all immigrants in West Midlands in 1861
		Up to 1861	*Percentage of population in* 1861		
West Midlands	1,616,195	441,439	27·3	—	—
Staffordshire	746,943	187,355	25·1	46·2	42·5
Warwickshire	561,855	169,304	30·1	34·7	38·4
Worcestershire	307,397	84,780	27·6	19·0	19·2
Black Country–Birmingham	835,002	225,635	27·1	51·6	51·1
Potteries	125,664	25,041	19·9	7·8	5·7
E. Warwickshire	86,816	14,088	16·3	5·4	3·2

These conclusions may be tested in two other parts of the West Midlands. The Potteries comprise the registration districts of Wolstanton and Stoke-on-Trent and cover roughly the Potteries region as defined by Wedgwood.[18] Here, although there was a high intensity of immigration, the greater part came from adjacent counties. Only from the northern counties, especially Lancashire, and the northern Welsh counties, especially Flint and Denbigh, was there a much higher proportion of movement into the Potteries than into the West Midlands as a whole. The numerically small movement from Cornwall to the Potteries formed a high proportion of movement from Cornwall to the West Midlands and especially to Staffordshire. Specific regional connexions in the china clay trade may have stimulated population

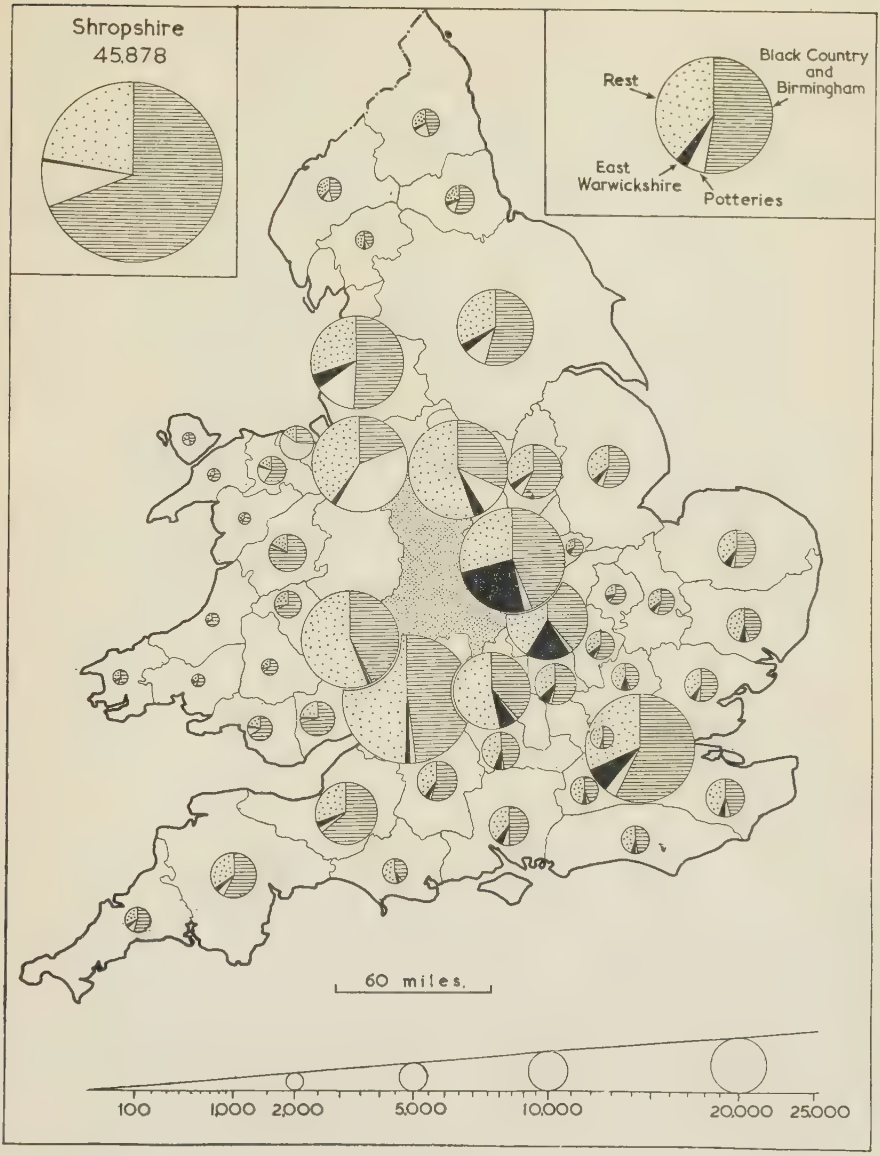

Fig. 5.—Immigration into the West Midlands up to 1861. The circles are proportionate to the total numbers of immigrants into the West Midlands from each county in England and Wales. The shaded segments show the relative proportions going to the Black Country and Birmingham, the Potteries, East Warwickshire, and the West Midlands.

movement. However, the Potteries was clearly a region less attractive to immigrants to the West Midlands, both absolutely and relatively, than was the Black Country and Birmingham. It had 7·8 per cent of the population of the West Midlands, but only 5·7 per cent of the immigrants, chiefly from adjacent areas. (See Table II.)

Movement of population into East Warwickshire (the Registration districts of Coventry, Foleshill, Nuneaton and Atherstone) was similar in character to that into the Potteries. Figure 5 reveals a predominantly short-range movement from the adjoining counties of Leicester and Northampton with a rapid diminution of intensity outwards, especially towards the southern fringes of Warwickshire. The proportion of all immigrants into the West Midlands which went to East Warwickshire (3·2 per cent) was low by comparison with the proportion of the total population resident there (5·4 per cent).

The relative importance of these three areas in relation to the total movement of population into the West Midlands up to 1861 has been summarized in a composite map of immigration (Fig. 5). Two fundamental features of the numbers and pattern of movement are apparent: first, the importance of short-range movement diminishing in strength away from the West Midlands, with the exception of notable long-range movements from London and, to a lesser degree, from Lancashire and Yorkshire; second, a widespread predominance of movement into the Black Country and Birmingham. This predominance breaks down only in localized cases as in the large movements of people from Cheshire into the nearby Potteries (41·1 per cent of the total movement from Cheshire into the West Midlands) or into East Warwickshire from Leicestershire (39·0 per cent of the total movement from Leicester into the West Midlands). Moreover, the Black Country and Birmingham attracted a high proportion of all migrants to the West Midlands from a large number of more distant counties in eastern and southern England and from most of Wales.

Outward movement from the West Midlands shows many contrasts to inward movements. Patterns of emigration can be mapped in greater detail for 1851 and 1861 to show the distribution of the natives of geographical counties over the registration districts of England and Wales and permitting fuller regional analysis. In 1861 there was large-scale emigration to nearby districts from all three counties (Fig. 6). But, in addition to this, there were a number of important longer-range movements to urban and industrial areas chiefly in south Lancashire and the West Riding of Yorkshire and to London. There were also lesser, though still significant, movements to north-eastern England with which there were distinctive regional connexions associated with the coal and iron industries. Although well established by 1861, emigration to north-eastern England was not to reach its full expression until the 1870's when the coal and iron industries of the Black Country and north Staffordshire declined in relative importance. Many miners and iron-workers and their families moved from the West Midlands to the developing heavy industrial areas of the northeast, notably, for example, to Middlesbrough. There are traces of a similar emigration to South Wales and Barrow from Staffordshire and Warwickshire.

The two types of emigration from the West Midlands were very different from each other. Short-range movements to areas immediately adjacent particularly emphasized the interchange of population between the West Midland counties, much of it, no doubt, from one part of the Black Country–Birmingham area to another. These areas were succeeded by a zone into which relatively little emigration had taken place. For example, within the English Plain there was a wide zone of low intensity of emigration, apart from a narrow corridor along the line of the railway routes between the West Midlands and London. Beyond this there was large-scale movement to Greater London, but, apart from this, only isolated islands of greater intensity of movement associated with emigration to towns such as Brighton,

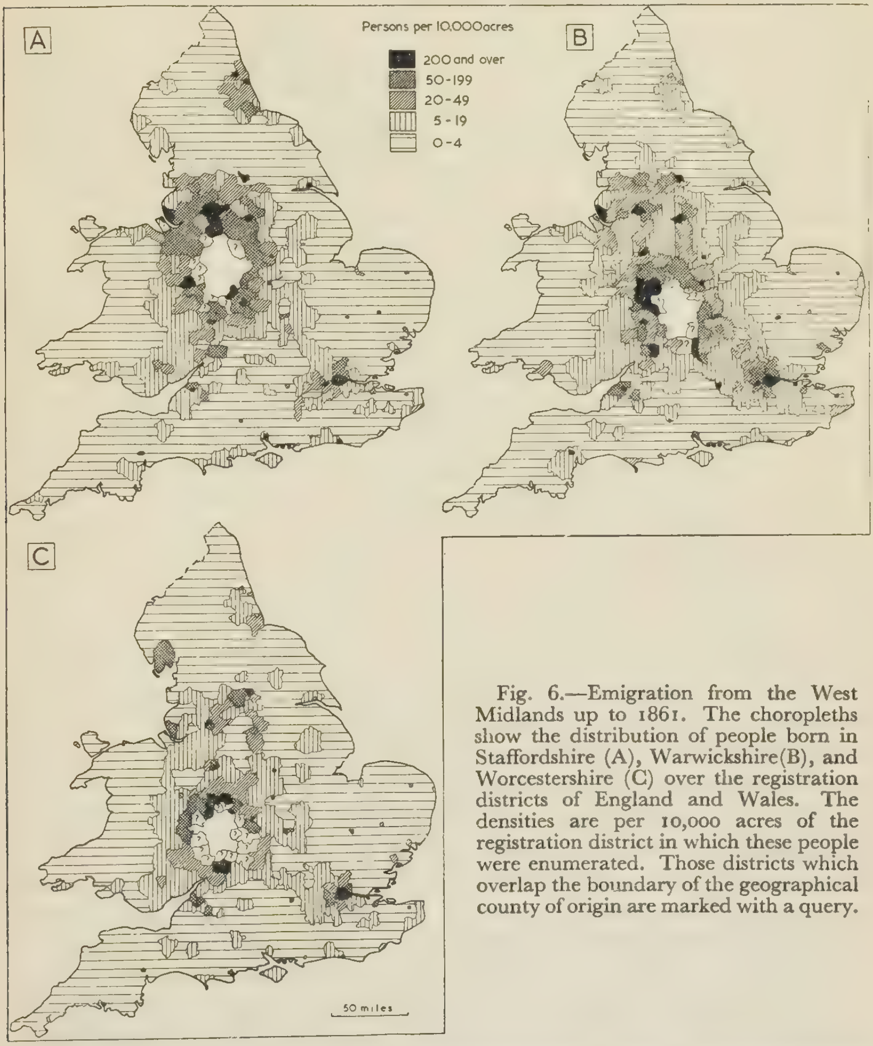

Fig. 6.—Emigration from the West Midlands up to 1861. The choropleths show the distribution of people born in Staffordshire (A), Warwickshire (B), and Worcestershire (C) over the registration districts of England and Wales. The densities are per 10,000 acres of the registration district in which these people were enumerated. Those districts which overlap the boundary of the geographical county of origin are marked with a query.

Hastings, Portsmouth and Plymouth. Northwards the pattern of emigration was more concentrated yet more varied. But, once again, rural areas were of little significance and attention was focused on the urban and industrial centres.

Thus, in the West Midlands, well-defined types and patterns of population movement existed in the mid-nineteenth century, which, while they must be tested in other areas, provide a basis for further investigation of population movements in nineteenth-century England. Within the West Midlands itself, urban growth and rural depopulation, with a steady short-range drift of population from country to town, were of fundamental significance. Such short-range drift, though often small in individual cases, was important in aggregate, especially in movement to the main towns and industrial areas. The attraction of rural population to the towns extended beyond the West Midlands over a large part of rural England. Indeed, up to 1861 immigration into the West Midlands exceeded emigration from that area in a wide belt from East Anglia to the West Country and south-western England and included the whole of Wales apart from Monmouth and Glamorgan. To these mainly rural counties the West Midlands acted as an area chiefly of absorption of population, to use Ravenstein's phrase.[19] The Black Country–Birmingham region attracted a large proportion of the longer-range migrants from this belt. In contrast, there was net outward movement from the West Midlands to south Lancashire, west Yorkshire and Greater London, the other great urban-industrial regions of the period.

Population trends are closely related to economic trends and population groups attract migrants in proportion to their size and rate of growth at any one time. The varied patterns of population movement in mid-nineteenth-century England gain coherence in relation to this concept. Any area of rapid population growth drew in people from surrounding rural areas, but its attraction diminished outwards in intensity until it was superseded by attraction from another area of rapid growth. On the other hand, outward movement of population from towns tended to go to other urban and industrial regions. Such migrations frequently involved longer-range movements. The volume and patterns of migration changed in response to fluctuations in the economy of the areas involved. Population movements were essentially dynamic, chronologically and spatially. The degree to which specific occupational links entered into inter-regional migration is difficult to assess. Such links have been suggested in the long-range movements between Cornwall and the Potteries and between the West Midlands and north-eastern England. But is it doubtful whether such connexions can, in themselves, ever dominate the sum total of population movement, though they may well be very significant.

REFERENCES

[1] An attempt had been made by Rickman, the supervisor of the censuses of 1801 to 1841, to calculate natural increase from baptismal and burial figures in Parish Registers. But these and the inferences made from them concerning population movements must be regarded with some reserve.
[2] Arthur Redford, *Labour Migration in England*, 1800 *to* 1850, Manchester, 1926.
[3] E. G. Ravenstein, "The laws of migration," *Journal of the Royal Statistical Society*, vol. 48, 1885, pp. 167–235.
[4] H. C. Darby, "The movement of population to and from Cambridgeshire between 1851 and 1861," *Geographical Journal*, vol. cl, 1943, pp. 1–8.
[5] C. T. Smith, "The movement of population in England and Wales in 1851 and 1861," *Geographical Journal*, vol. cxvii, 1951, pp. 200–10.
[6] E. C. K. Gonner, "Population of England in the eighteenth century," *Journal of the Royal Statistical Society*, vol. 86, 1913.
[7] C. T. Smith (*op. cit.*) has drawn attention to the significance of the West Midlands as an important goal for immigrants.
[8] H. Evershed, "The agriculture of Staffordshire," *Journal of the Royal Agricultural Society* (*2nd series*), vol. v, 1869, p. 475.
[9] J. Caird, *English Agriculture in* 1850–1851, London, 1852, p. 474; and H. Evershed, *op. cit.*, p. 269.
[10] A. Redford, *op. cit.*, p. 160.
[11] J. Wedge, *On the Agriculture of Warwickshire*, London, 1794.
[12] Reported in J. A. Langford, *A Century of Birmingham Life*, 1741–1841, vol. i, Birmingham, 1868, p. 297.
[13] Quoted by C. R. Fay, *Life and Labour in Nineteenth Century England*, Cambridge, 1947, p. 104.
[14] J. Caird, *op. cit.*, p. 251.
[15] H. Evershed, *op. cit.*, p. 309.
[16] See C. T. Smith, *op. cit.*, especially p. 200, for a fuller analysis of this feature.
[17] G. C. Allen, *The Industrial Development of Birmingham and the Black Country*, London, 1929, p. 457, Table II.
[18] J. C. Wedgwood, *Staffordshire Pottery and its History*, London, 1913, p. 2.
[19] E. G. Ravenstein, *op. cit.*

Fifteen Years of Agricultural Change

A Study of Sample Counties in England and Wales

1939–1954

HILARY C. CHEW

CHANGES IN FARMING PRACTICES and land-use distributions that have taken place since 1939 in England and Wales, chiefly in response to economic forces, vary in nature and degree from area to area and conform to a relatively clear-cut pattern over the country. The annual county returns of the Ministry of Agriculture[1] (used in the construction of Fig. 1) illustrate this fact. Variations from year to year in the percentage of the improved land under each of the four land uses—permanent grass, temporary grass, fodder crops, and cash

➤ Miss Chew is a member of the research staff of the Faculty of Economic and Social Studies of the University of Manchester. Her article is based on a paper read to Section E of the British Association for the Advancement of Science on 6th September 1955. She has previously contributed a paper on Agricultural Geography to *Geography* in 1953.

crops—provide a key to changes in the relative importance of different farming activities. Examination of the returns and comparison of pre-war and post-war distributions reveal that the counties fall into five major groups according to the more outstanding changes.[2] These groups (see Fig. 1) correspond approximately to major regional divisions of the country.

Group 1 includes counties of the high dissected uplands or exposed and windswept areas at lower altitudes. The easterly flanks of the uplands and the lowlands adjacent to them, with climatic conditions, relief and soils more favourable for agriculture, fall into Group 2. This group includes counties largely given over to dairying (e.g., Cheshire) together with others (e.g., Shropshire) where the total area is more evenly divided among a number of different farming types. Further east and southeast Group 3 comprises chiefly areas of subdued relief where climatic conditions are akin to those of the pre-war arable areas of eastern England. Heavy clay soils occur over extensive areas, for example over much of Leicestershire where grassland prevailed so largely before the war. In counties of Group 4 both arable and grassland farming were well represented in 1939, the former associated with free-working and the latter with heavy soils, and Group 5 comprises primarily the established arable farming areas of the eastern counties.

A comparison of detailed changes (which is made below in studies of representative counties) allows an assessment of the degree of response to modifying influences, and broadly there is a contrast between Groups 1 and 2 and Groups 3, 4 and 5. In the more westerly groups changes are limited chiefly to improvements to the pre-war type of farming, which was already carefully adjusted to local conditions; the limiting factors, especially of relief and climate, appear to be effective still. On the other hand in the more easterly and lowland areas there are more radical changes of land use, stock husbandry, and consequently of agricultural distributions. Technical advances (notably mechanization, improved drainage,[3] the use of adequate fertilizers and improved seed) have overcome problems arising primarily from the nature of the soil and farming in these areas has been more extensively modified to meet new economic demands.

Within the more easterly areas the changes have however been conditioned both by pre-war farming practice and by physical factors. Where the major established activity has been stimulated and now gives reliable returns, as in dairying districts, few other activities are carried on unless they are complementary to it or further its efficient development. Specialization therefore generally remains typical, particularly where physical conditions are most favourable for the major activity and holdings are relatively small. Where the major activity has not been stimulated or gives less reliable returns it has given ground to new activities resulting in a more broadly based and potentially more stable economy. This is illustrated in the specialized

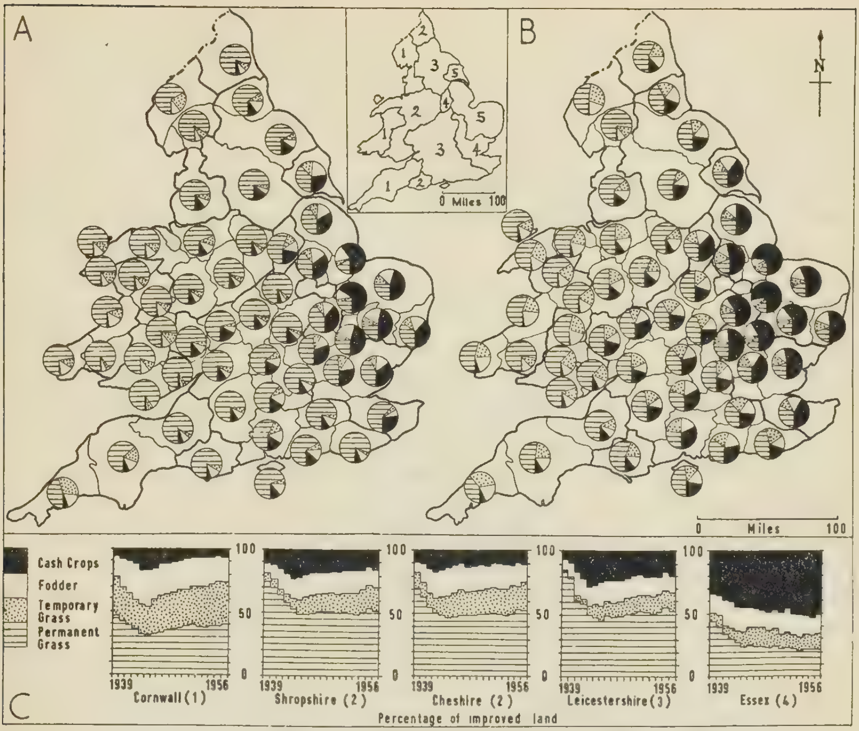

Fig. 1.—Land Use in England and Wales (A) 1939 and (B) 1954. C. Trends in the use of improved land in representative counties 1939 to 1956. County grouping according to changes: 1. Little change, grassland dominant. 2. Increase of arable land chiefly under fodder and temporary grass. 3. Marked increase of arable land under cash crops, fodder and temporary grass. 4. Marked increase of arable land chiefly under cash crops. 5. Relatively little change, arable farming dominant. On these and all other maps the chief crops in the cash crop group are wheat, barley, sugar-beet, potatoes, vegetables and fruit; and in the fodder group, oats, mixed corn, roots, and green fodder crops.

grassland fattening and rearing areas of the Midlands, or, more strikingly, in the areas of arable sheep husbandry, a practice that was already declining in the 1930's and of which so little now remains. Mixed farming areas have maintained a varied economy expanding more fully those activities which meet increased demands. Changes are however everywhere less evident where holdings include only small acreages of improved land and mechanization is less profitable, where little capital is available or expensive facilities such as buildings or adequate water supplies are lacking if these are needed for the successful adoption of new activities.

Consequent upon changes in farming practice, dairy stock, arable land, wheat, oats, temporary grass and green fodder crops have become more evenly distributed over a wider area and the distinctiveness of the various farming regions, particularly in the easterly counties—Leicestershire, Nottinghamshire, Essex, Kesteven and

Lindsey—has been reduced. On the other hand crops such as malting barley, sugar-beet and potatoes have shared less fully in the extension of cropping through their more exacting requirements, especially of soil texture and depth, and they retain to a much greater extent their pre-war distributions.

During the war agricultural potentialities were tested afresh with the aid of new techniques and equipment. Demands for a wide range of produce, supported by subsidies and guaranteed prices, have encouraged the continuation of a diverse and flexible farm economy and the retention of successful new practices. However, new practices have been largely abandoned if they have proved incompatible with eminently successful activities previously established, or have shown themselves precarious or unprofitable because of the limitations of particular environments. Movements towards the pre-war type of farming were greatest in the immediate post-war period as soon as compulsory cropping was no longer enforced. In most areas year-to-year fluctuations in the acreages under grass and the chief groups of crops have subsequently been small (Fig. 1 c). Some greater fluctuations that are discernible over considerable areas of the country may be related with periods of adverse weather that are liable to disrupt normal cropping in the more exceptional seasons, particularly in the areas of heavier soils. For example the temporary fall in the acreages in tillage in many counties in 1955 can be related with the extremely wet weather of the previous autumn and spring that interfered with the preparation of the land and the sowing of crops. It seems ironical that cereal acreages should have been limited prior to a good harvesting season but that favourable weather for cultivation in the following autumn and spring should precede the unfavourable harvesting season of 1956. In this year crop acreages in most counties were again generally comparable with those of 1954 (Fig. 1 c).

THE SAMPLE COUNTIES

The counties for discussion selected from each group illustrate the different environments and major types of farming encountered from west to east across the country. Statistics for sample parishes representative of each of the chief farming regions and types of terrain in each county have been used as a main source of information. The parish areas to which the returns refer in some cases include greatly differing types of land. Since many of the individual farms include the same variety of land as do the whole parishes, the returns reflect clearly the main characteristics of local farm organization. Comparison of the returns for different years shows the major changes in the types of farming practised, although the exact distribution of crops and stock relative to the different types of land is not revealed. Field observations and additional data have been used in checking inferences drawn from the parish returns.

As far as possible the parishes selected to serve as illustrations fulfil the following conditions: the total area of improved land is approximately equal in each year 1939, 1943 and 1954; the returns for 1939 reflect the chief features described in the relevant Land Utilization Survey *Reports*;[4] the parishes are situated away from the margins of the farming regions to minimize the chance of atypical areas beyond the civil parishes being included in the 'agricultural' parishes; areas of local specialization within the major regions are avoided, e.g., market gardening and fruit growing districts in Essex and Nottinghamshire, since discussion of such activities is beyond the scope of this paper. In addition detailed comparison of stock densities and changes in acreages of rough grazings are excluded since the parish returns omit rough grazings held in common and considerable acreages are so held in the upland areas.

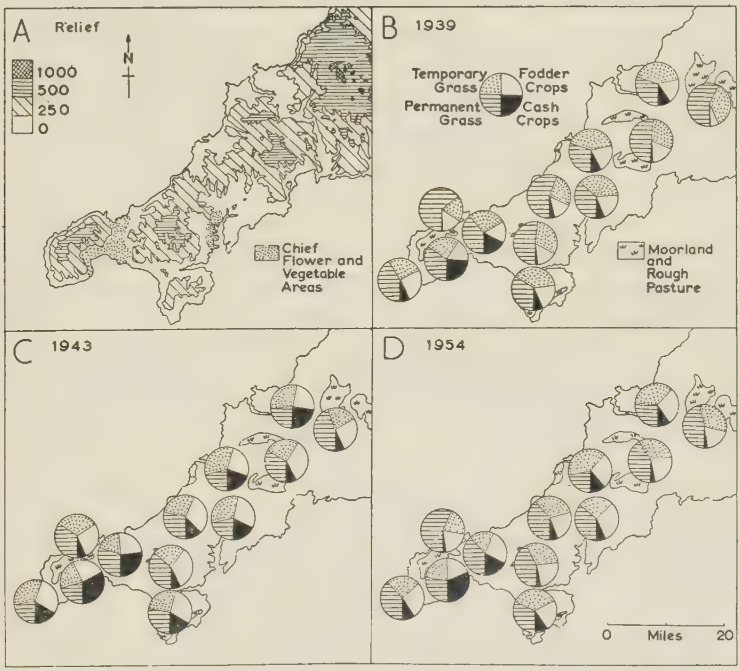

Fig. 2.—Land-use changes in Cornwall 1939 to 1954.

Cornwall (*Group* 1)

In Cornwall the relief of most of the improved land is not unfavourable for tillage but high rainfall and strong winds seriously hinder cereal growing. Farms are relatively small. Over two-thirds of the improved land is in holdings of less than 150 acres, and nearly half of it in holdings of under 100 acres,[5] a potential limitation for efficient mixed farming.

In both 1939 and 1954 a close adjustment of land use to stock requirements is evident (Fig. 2). Of the war-time cash crops the cereals have failed to persist and potatoes alone partially retain their importance, chiefly where they had previously occupied considerable acreages. The increased plough-land maintained in all areas for fodder production, mainly under oats or mixed corn despite climatic disadvantages, is enforced by the great demand for winter feed and its high price commercially. Even though damaged by adverse weather, fodder crops, unlike cash crops, retain much of their value for use on the farm. Nevertheless acreages are relatively small in the parishes of the moorland margins with especially difficult physical conditions.

Mixed stock husbandry remains the major type of farming with particular emphasis on dairying which has benefited especially from improved marketing facilities. Milch and young female cattle have become more numerous and subsidies for beef stores introduced in 1951 are also reflected in the parish returns, especially those of the moorland margins. Improvement and increased scale in farming operations, chiefly on the larger holdings, are also evident. Traditional earth banks have been removed to facilitate mechanization even though stock are thus deprived of shelter and crops are more exposed to damaging winds. Rough grazings on lower levels have been reclaimed and cropped or reseeded to an improved sward, and attempts made to improve moorlands over 800 feet above sea level on Bodmin Moor by draining, seeding and using sea sand.[6] Such improved land has been incorporated into the established systems of farming. It seems that a relatively strict limit is set to the farming activities that can be profitably practised within this environment even in a time of agricultural prosperity. Moreover the pre-war type of farming served market demands that have been intensified and little would be gained by its modification except for the purpose of reducing costs and achieving greater efficiency.

The specialized flower and vegetable districts dependent on local advantages retain their identity,[7] and the high moorlands still stand out in marked contrast to the adjacent lands under improved farming. Both agricultural patterns and the essential character of farming have suffered a minimum of modification since the 1930's.

Merioneth, Montgomery, and Shropshire (*Groups* 1 *and* 2)

These counties together include a section of the western uplands and a considerable area of the lowlands lying to the east of them where more diverse farming prevailed in 1939. In the stock-rearing upland parishes, extending from the rough hill pastures to the improved land of the valleys, events have followed the sequence noted in the Cornish parishes and the war years have left little mark on the land use of these rigorous uplands (Fig. 3). Tillage is restricted chiefly to the lower valleys and plateaux. In particularly exposed or elevated areas, over 1,000 feet above sea level, ploughing usually serves only to improve the sward though occasional crops are obtained.[8]

In contrast, throughout the lower lands of eastern Montgomeryshire and Shropshire, where mixed stock husbandry with marked interest in dairying was characteristic but gave way to specialized dairying towards the north, much of the additional tillage has been maintained, a feature specially noticeable in parishes of the lower Clee Hill platform and the southern scarplands, relatively level areas where heavy soils limited ploughing in pre-war days (Fig. 3). The previously established mixed farming area on the free-working soils along the eastern border of Shropshire records the widest variety of crops including substantial acreages under malting barley and sugar-beet. The areas of heavier soil towards the west and south of the county show a more limited range and wheat is the major cash crop. In the most intensive dairying area in northern Shropshire cash crops, not unexpectedly, are of small importance.[9]

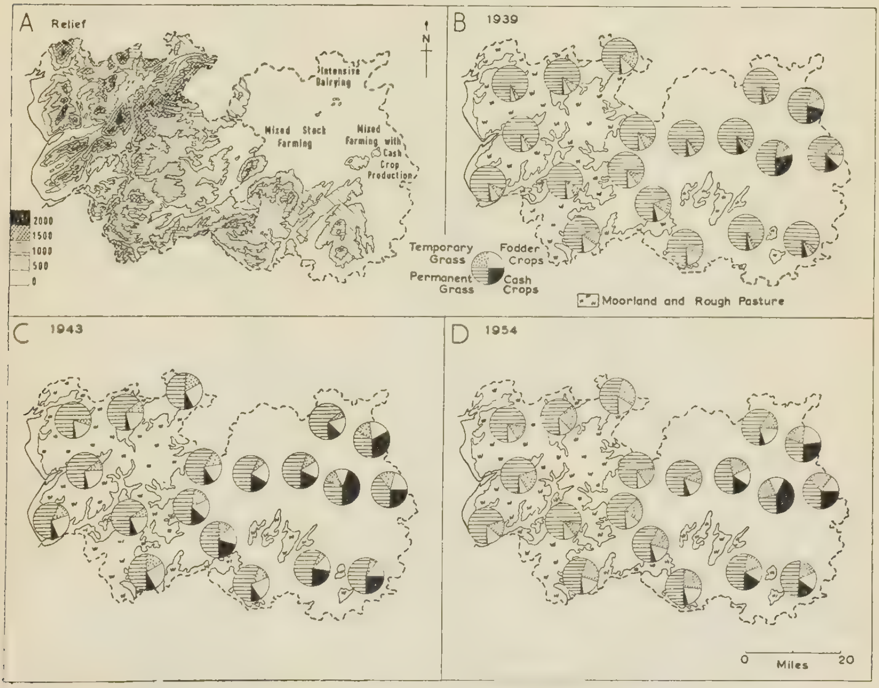

Fig. 3.—Land-use changes in Merioneth, Montgomery, and Shropshire 1939 to 1954.

Numbers of grazing stock have increased in all areas since more intensive land use permits heavier stocking despite reductions in grassland and increased cash crop acreages. In western upland parishes the proportions of different types of stock in the total show little change (see Table I), but towards the eastern margins of the uplands, which are more accessible from west Midland markets, sheep have given place to milch cattle and young stores, and greater interest in dairying with breeding and rearing is evident. On the lowlands such changes are even more marked (Table I), and in the south numerous Friesian and Ayrshire herds are now intermingled with the more typical Herefords.[10]

In these three counties the results of the modifications to land use and to stock farming are a strengthening of the contrasts between the uplands on the one hand and the lowlands on the other, and increased homogeneity among the different farming sub-regions of the lowland areas.

Leicestershire and Nottinghamshire (*Groups* 3 *and* 4)

The pre-war farming regions distinguished in these counties were based primarily on soil types which were themselves directly dependent on parent materials. Arable cereal and sheep farming on the poor sandy soils of western Nottinghamshire contrasted sharply with the mixed farming of the eastern areas where a high percentage of the land was under permanent grass, especially on the heavier soils of the Keuper Marls. Southwards the area under permanent grass was still greater on the heavy clay-loams extending into western Leicestershire where specialized dairying was the major activity, and in the grazing areas of eastern Leicestershire almost unbroken grassland occupied the heavy soils developed on the Lias and Boulder Clays, and the river-side alluvial strips (Fig. 4).

Table I

GRAZING STOCK IN MAJOR FARMING REGIONS OF SAMPLE COUNTIES

Percentage of total cattle and sheep in various groups (based on statistics for groups of sample parishes; cattle each equal 1 stock unit; sheep each equal $\frac{1}{7}$ unit)

		Milch Cattle		*"Other" cattle under 2 years*			*"Others" over 2 years*		*Sheep*	
		1939	1954	1939	1954 *Females*	1954 *Males*	1939	1954	1939	1954
Merioneth, Montgomery and Shropshire	Western uplands	11	11	19	8	8	6	8	64	65
	Eastern uplands	20	25	30	18	12	5	7	45	38
	Lowlands	39	44	28	26	11	9	7	24	12
Nottinghamshire and Leicestershire	Northwestern Notts.	21	23	29	19	20	14	19	36	19
	South and east Notts.	37	40	34	26	14	13	15	16	5
	Western Leics.	42	50	34	27	7	8	8	16	8
	Eastern Leics.*	24	29	30	21	13	21	22	25	15
	Southeast Leics.	7	19	12	10	6	62	45	19	20
Essex	North central area	45	47	31	30	13	4	9	20	1
	Southern dairying area	58	50	23	24	12	8	11	11	3
Lindsey	Heath and northern arable area	21	23	30	15	17	16	26	33	19
	Central mixed area	25	24	36	18	19	13	21	26	18
	Wolds arable area	23	25	22	18	12	5	10	50	35
	Eastern mixed area	31	35	36	20	17	16	17	17	11

* Excluding the Vale of Belvoir dairying area.

On the light soils of western Nottinghamshire cropping has been modified. Roots and oats, which were grown chiefly for sheep feeding, have given ground to cash crops—potatoes, sugar-beet, and vegetables with barley now the chief cereal—but this substitution has not caused a radical change in the type of rotation (Table II). The introduction of satisfactory seeds mixtures, especially lucerne and cocksfoot, has facilitated the improvement of pastures on these "droughty" soils and many farms now maintain small milking herds. Sheep however have been reduced to about half their pre-war number (Table I) and "grass" breeds, frequently kept only for short periods, have been replacing the "arable" breeding flocks that formerly tended to dominate farm organization.[11]

Elsewhere in these two counties the tillage that invaded all areas during the war has everywhere been retained as an essential feature of farming practice (Fig. 4). In eastern and southern Nottinghamshire stock remain of particular importance but arable cropping has been extended. On the lighter soils associated chiefly with the Trent deposits and Keuper waterstones and skerry beds, where arable production was more common in the 1930's, crops similar to those of the western sandy areas are grown, but on the heavier soils, as in Shropshire, the range is more limited and wheat and oats are the major cereals[12] (see Fig. 4 and Table II).

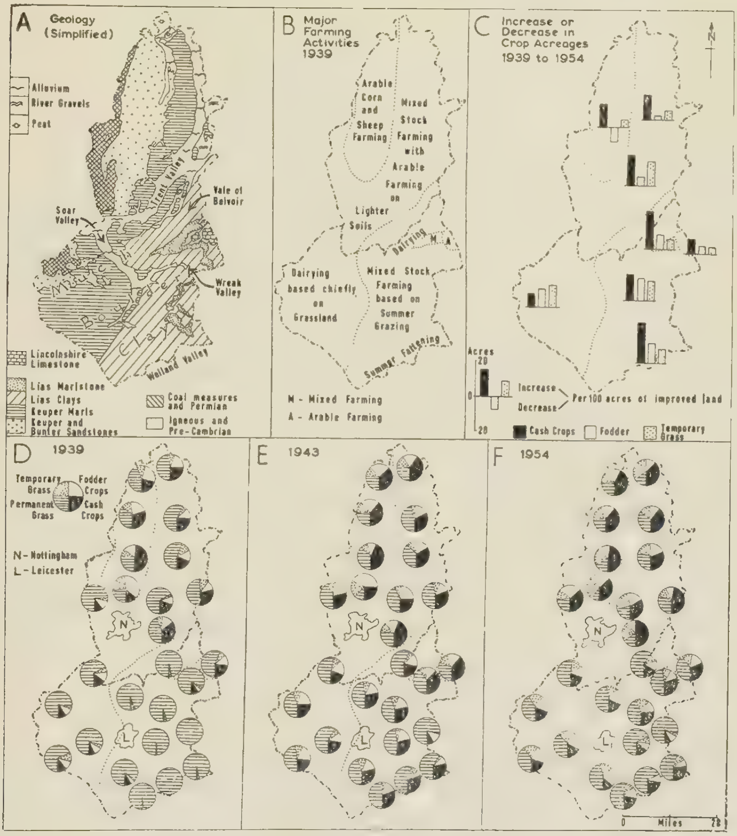

Fig. 4.—Land-use changes in Leicestershire and Nottinghamshire 1939 to 1954.

Changes in Leicestershire generally resemble those common in eastern and southern Nottinghamshire, but new cropping practices vary noticeably according to the needs of the stock typical of different areas. The western dairying area records the highest acreages of fodder and temporary grass. Here, incidentally, permanent grass was only of moderate quality in 1940.[13] Towards the east, although dairying has become a more important activity on the majority of farms, mixed stock farming based upon summer grazing remains general and winter feed requirements are smaller; hence the relatively larger proportion of the arable land under cash crops. This feature is especially marked in the extreme southeast, the Welland district, where summer fattening advanced stores on permanent grass is still the major activity and few animals are carried through the winter (see Fig. 4 and Tables I and II).

The rotation most commonly adopted on the clay-loams in the county is that which was usual on the small area of arable land remaining in the enclosed parishes at the beginning of the nineteenth century.[14] After several years' cropping with cereals and roots or green fodder the land is laid to grass for a varying period. Wheat is the chief cash crop and sugar-beet, potatoes and barley are important only where friable soils occur, as along the terraces of the Wreak and Soar valleys or on the skerry beds or Liassic Marlstone (Table II). In the extreme northeast of Leicestershire on the light shallow soils developed on drift-free Lincolnshire Limestone which support only poor permanent grassland the arable farming that generally prevailed previously has become more intensive and resembles that of the adjacent area of Kesteven. A four-course rotation is usually followed and barley occupies about half the arable land, but roots have decreased in importance.

In all areas of Leicestershire and Nottinghamshire dairying has gained in importance and in western Leicestershire, where it retains its specialized character and dominance, grazing stock numbers in many parishes have increased by as much as 20 per cent or 10 sheep and cattle units per 100 acres of farm land. The converse is true of specialized fattening and in the Welland district, where other activities have gained much ground, stock numbers, chiefly summer grazing animals, have fallen by about 20 per cent or 24 units per 100 acres of farm land—a decrease that can be directly related to the ploughing of pastures. This trend is in part a reflection of the high price and shortage in the market of good quality advanced store beasts that will finish well on first-class pastures. Such pastures are unsuitable for and are considered to be wasted upon young stores and few are reared in the area (Table I). Elsewhere changes in total grazing stock numbers have been small and more intensive farming has apparently compensated for reduced grassland. In eastern Leicestershire as a whole the high quality permanent grass remains of especial importance but greater economic stability is derived from the more diverse land use.[15]

Essex (Group 4)

Essex in the 1930's comprised two main farming regions: the northern area, part of arable East Anglia, where the subsequent intensification of tillage might well have been anticipated; and the sharply contrasted grassland dairying area in the south on the cold heavy soils of the London Clays where the few scattered arable fields were associated with the lighter soil patches. Despite their heavy nature the soils of the London Clays now also produce a variety of crops and although more intractable than those of the neighbouring boulder clays, under skilful management they give good yields[16] (see Fig. 5 and Table II). Not only have fodder acreages increased but cash crops, formerly of negligible importance, in 1949 contributed 34 per cent of farm income on the London Clay soils. This is only half the corresponding figure (69 per cent) recorded in the Rodings,[17] part of the northern arable area, but it indicates the magnitude of the change that has taken place in the farming economy of this heavy-land dairying area. It is significant that in southern Essex as in eastern Leicestershire the bulk of the land is in holdings of 150 acres or more—large enough to be worthwhile to equip with the necessary power machinery and to run profitably as mixed arable and stock farms.

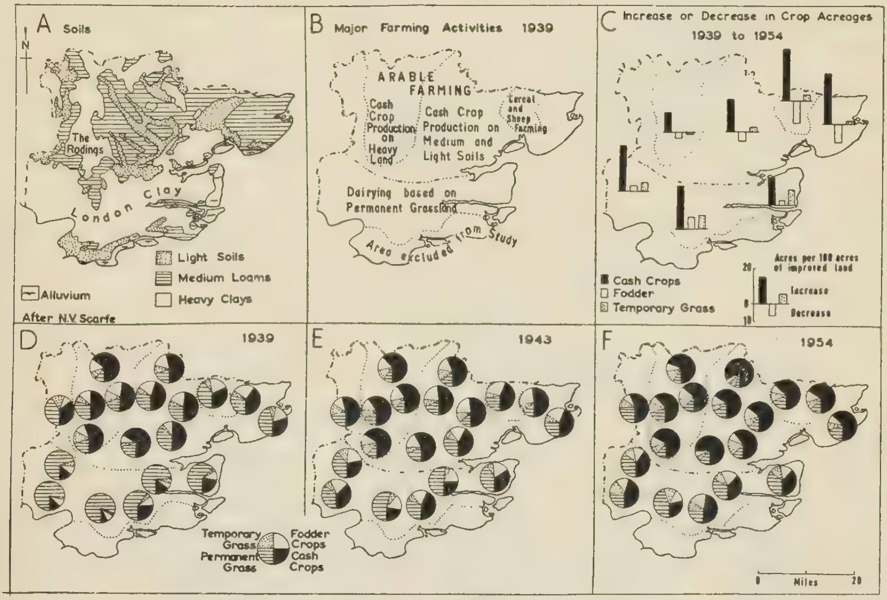

Fig. 5.—Land-use changes in Essex 1939 to 1954.

In the sample parishes of this southern area both sheep and cattle, including milch cattle, have decreased and total sheep and cattle units in 1954 stood 15–20 per cent below the 1939 number. The extension of cash crop production is doubtless partly responsible. In dairying however the chief interest is now the improvement of stock and milk yields, and a decrease in milch cattle does not necessarily imply a decline of this activity. Nevertheless it may be of significance that this area is not physically especially favourable for dairying and the earlier advantage of nearness to the London market is now largely discounted by the extension of efficient and economic milk collection to distant areas.

In northern Essex changes in both crops and stock generally resemble, especially on the more friable soils, those noted in western Nottinghamshire, though wheat is more important and cropping varies locally according to the nature of the soil.[18] Temporary pastures have been improved and dairying has gained in importance (see Fig. 5 and Tables I and II). The sharpness of the contrasts between northern and southern parts of the county has been reduced and the climatic advantages for arable production possessed by the county are reflected in the extended tillage of both areas.

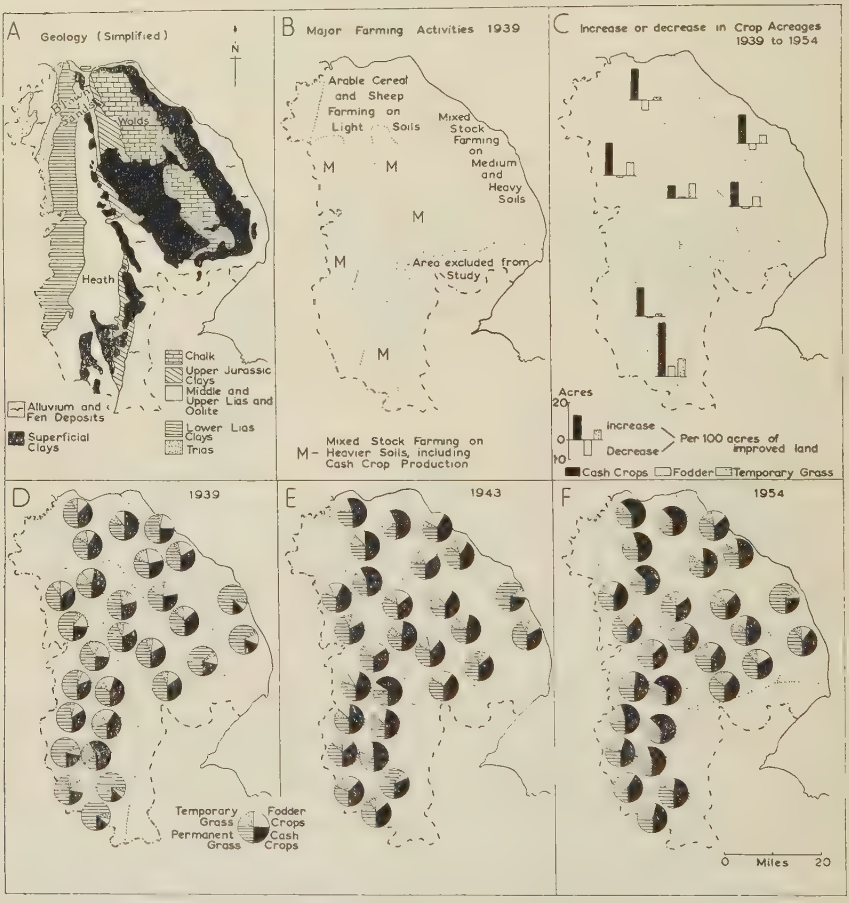
A Geology (Simplified)
N
Blown Sands
Wolds
Heath
Chalk
Upper Jurassic Clays
Middle and Upper Lias and Oolite
Lower Lias Clays
Trias
Alluvium and Fen Deposits
Superficial Clays
B Major Farming Activities 1939
Arable Cereal and Sheep Farming on Light Soils
Mixed Stock Farming on Medium and Heavy Soils
M
Area excluded from Study
M – Mixed Stock Farming on Heavier Soils, including Cash Crop Production
C Increase or decrease in Crop Acreages 1939 to 1954
Acres
20
0
10
Increase
Decrease
Per 100 acres of improved land
Cash Crops
Fodder
Temporary Grass
D 1939
E 1943
F 1954
Temporary Grass
Permanent Grass
Fodder Crops
Cash Crops
0 Miles 20

Fig. 6.—Land-use changes in Kesteven and Lindsey 1939 to 1954.

Kesteven and Lindsey (*Group* 5)

In this part of the scarplands the arable side of farming has been strengthened everywhere. Modifications to farming on the heavier lands of the vales and on the lighter limestone and chalk lands respectively

Table II

CROPPING IN MAJOR FARMING REGIONS OF SAMPLE COUNTIES

Acreages under the chief cash and fodder crops, per 100 acres of total crops and grass. (Based on statistics for groups of sample parishes)

		Cash Crops										*Fodder Crops*						*Total of these Crops*		*Increase in Area*
		Wheat		*Barley*		*Potatoes*		*Sugar-beet*		*Vegetables*		*Oats*		*Mixed Corn*		*Roots*				
		1939	1954	1939	1954	1939	1954	1939	1954	1939	1954	1939	1954	1939	1954	1939	1954	1939	1954	
Leicestershire	Western dairying area	7·6	12·6	0·5	3·0	0·9	2·8	0·3	0·3	0·1	0·2	4·6	8·0	0	7·2	2·8	1·8	16·8	35·9	19·1
	Eastern grazing and dairying area	0·8	14·5	0	2·9	0	2·8	0	0·1	0	0·3	0·3	7·2	0	2·9	0·2	0·8	1·3	31·5	30·2
Nottinghamshire	NW. light land arable area	10·6	8·1	5·0	18·8	3·1	10·0	2·0	5·0	0	1·8	15·6	9·0	0	0·5	6·7	4·2	43·0	57·4	14·4
	NE. mixed farming area	17·0	22·0	0·3	8·8	1·2	2·5	1·6	2·2	0·5	1·6	4·7	6·9	0	1·5	1·2	1·5	26·5	47·0	20·5
	S. dairying and mixed farming area	11·6	20·8	2·2	8·8	1·6	3·2	0·9	1·9	1·3	1·6	5·6	9·2	0·2	3·2	2·7	2·2	26·1	50·9	24·8
Essex	NW. medium-heavy land arable area	25·7	25·8	16·7	21·5	2·6	5·6	4·4	6·2	1·2	4·5	5·8	5·1	0	0·3	0·4	0·1	56·8	69·1	12·3
	North central arable area	20·6	21·5	10·1	18·0	2·0	4·5	3·6	6·1	8·4	11·5	4·9	4·5	0·1	0	1·7	0·7	52·4	66·8	14·4
	Southern dairying area	6·1	21·5	1·6	7·5	0·9	2·8	0·3	0·4	0·8	2·0	3·4	8·0	0	2·5	1·5	0·3	14·6	45·0	30·4
Lindsey	Heath and northern light land arable area	15·9	18·5	11·6	18·7	6·9	7·8	8·1	8·4	0·9	4·8	6·0	3·3	0	0·1	5·1	1·2	54·5	62·8	8·3
	Central mixed farming area	17·4	19·5	6·2	11·8	0·6	1·2	3·2	4·0	0·6	2·8	5·3	5·0	0	0·9	2·0	2·1	35·3	47·3	12·0
	Wolds light land arable area	6·1	9·9	17·6	22·9	0·1	3·6	0·7	1·3	0·8	2·6	5·3	5·8	0	0·2	13·1	7·7	43·7	54·0	10·3
	Eastern mixed farming area	15·8	17·9	4·0	11·3	0·6	2·9	0·6	1·7	1·4	5·1	7·3	3·9	0	0·7	2·2	1·5	31·9	45·0	13·1

generally resemble those of the Midland clay areas and western Nottinghamshire (see Fig. 6 and Tables I and II). Tillage acreages are however relatively greater and dairy stock less prominent in Lincolnshire. Variations in the land-use pattern associated with different soil types have become less obvious in the field and the individual farming sub-regions less distinct. Improved farming methods, especially deep ploughing on the shallow soils of the Wolds and improved drainage in the vales, have facilitated the extension of tillage and a wide variety of crops is grown, including considerable acreages of vegetables and crops grown for seed.[19] The combinations grown in different areas vary according to live stock requirements, soil texture and depth, and the facilities of individual holdings.

The extension of dairying, although hampered by unsuitable farm buildings and (especially on the Wolds and the Heath) by the difficulty of obtaining an adequate water supply, had begun prior to 1939 as had the modification of arable sheep husbandry, chiefly by the introduction of extra cash crops. Such earlier developments foreshadowed the main agricultural changes of subsequent years.

REFERENCES

[1] Ministry of Agriculture, Fisheries and Food, *Agricultural Statistics*, *England and Wales*, Part I, 1939 to 1956.

[2] For further discussion see H. C. Chew, "Changes in land use and stock over England and Wales 1939 to 1951," *Geographical Journal*, vol. 122, 1956, pp. 466–70.

[3] Work in Buckinghamshire has shown that on heavy land poor drainage is the most potent single factor adversely influencing crop growth, and that heavy losses that occur on undrained land in wet years can be avoided by efficient drainage. See E. H. Brant, "Land drainage in north Buckinghamshire," *Agriculture*, vol. 61, 1954, p. 497.

[4] L. D. Stamp (ed.). *The Land of Britain. Land Utilisation Survey Reports. Cornwall*, B. S. Roberson, London, 1940. *Merioneth*, L. A. Holliday, London, 1940. *Montgomery*, J. May and S. Wells, London, 1942. *Shropshire*, E. J. Howell, London, 1941. *Leicestershire*, R. M. Auty, London, 1943. *Nottinghamshire*, K. C. Edwards, London, 1944. *Essex*, N. V. Scarfe, London, 1942. *Kesteven and Lindsey*, L. D. Stamp, London, 1942.

[5] Ministry of Agriculture Statistics, *England and Wales*, Part I. H.M.S.O., London, 1955.

[6] H. Burr, "Some problems of the Southwest: Cornish Commons," *Journal of the Royal Agricultural Society*, vol. 112, 1952, p. 19.

[7] See S. P. Craze, "Penzance District," *Agriculture*, vol. 58, 1951, p. 139.

[8] See D. R. Browning, "Clun Forest Farm," *Agriculture*, vol. 59, 1952, p. 538. For an account of farm improvements in the hills of southwestern Shropshire see also W. D. Whitehouse, "The Shelve Estate," *Agriculture*, vol. 62, pp. 35–9.

[9] For an account of farming changes in the dairying area of southern Cheshire of which this is an extension see E. S. Simpson, "The Cheshire grass-dairying region," *Trans. Inst. British Geographers*, No. 23, 1957, pp. 141–62.

[10] See W. Rolls, "Southern Shropshire," *Agriculture*, vol. 59, 1952, p. 591.

[11] See J. D. Chambers, "The problem of Sherwood Forest," *Agriculture*, vol. 62, 1955, p. 179, and J. S. Hopkins, "Nottinghamshire Farming," *Agriculture*, vol. 62, 1955, p. 175.

[12] J. S. Hopkins, *op. cit.*

[13] Ordnance Survey, *Vegetation Map of Great Britain* Sheet 2, 1/625,000, 1945.

[14] W. Pitt, *A General View of the Agriculture of Leicestershire*, London, 1809, p. 90.

[15] For a discussion of the distribution of arable land see H. C. Chew, "The post-war land-use pattern of the former grasslands of eastern Leicestershire," *Geography*, vol. xxxviii, 1953, pp. 286–95.

[16] P. J. O. Trist, "Essex and Suffolk Clays," *Agriculture*, vol. 58, 1951, pp. 176–82.

[17] A. W. Menzies Kitchen, "The Eastern Province. Farming variations and soil types," *Agriculture*, vol. 58, 1951, p. 162.

[18] P. J. O. Trist, *op. cit.*

[19] Many parishes of Kesteven and Lindsey extend considerably beyond the limits of the land-use regions and the returns are therefore rather less satisfactory than those used to illustrate other counties. For further details of cropping see G. B. Wells and A. Mann, "Kesteven and Lindsey," *Agriculture*, vol. 54, 1947, p. 135.

Recent Trends in the Lorraine Iron and Steel Industry

J. E. MARTIN

In recent years schemes for reorganizing the West European industrial economy have had much publicity. Outstanding among these has been the Schuman plan for international co-operation in the coal and steel industries, while on the national level the Monnet plan with its proposals for the development of the French industrial economy has also been of major importance. Few attempts have yet been made to examine the geographical changes resulting from the application of these plans. Some years ago J. A. Coker indicated probable geographical consequences of the Schuman plan for Western Europe. Here it is proposed to consider in detail the effect of these plans upon one industrial region, the Lorraine iron and steel producing district.

It is important first of all to note that prominent among the proposals contained in the Monnet plan was the introduction of new and advanced industrial techniques with the aid of state loans. Major technical improvements have been achieved in five principal sectors of the Lorraine iron and steel industry: ore mining, ore preparation, the carbonization of coal, generation of electricity and iron and steel production.

Ore mining

Lorraine ore is lean, having an average iron content of only 32 to 33 per cent. Intensive research has so far produced no economic means of concentrating this ore. However, the efficiency of extraction makes Lorraine ore cheap at the mine even for a lean ore. It may thus be delivered at competitive prices as far afield as Denain (Département du Nord) and Charleroi (Belgium) despite its leanness (Table I).

Physical conditions are very favourable for modern methods of large-scale mining. The ore formation may be reached by adits (nearly 40 per cent of current output) or by shallow shafts. Beds are generally thick reaching a maximum of 30 feet, and working faces have a minimum of 7 feet of productive beds. Dips are slight, faulting is local and roof conditions are good. As a result working space is usually ample. The most impressive progress in recent years has been attained in face working. Drilling machines have replaced hand working, while new loading machines of American and French design

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have been introduced. By 1955, 91 per cent of ore was mechanically loaded and output per manshift at the face has risen notably. Shuttle cars have been introduced to carry ore to the main haulage system, but it has proved difficult to adapt haulage to the new rhythm of production in mines that have been developed for many years. Electric trains were in normal use underground in this field before 1939 but with narrow gauges, modest speeds and tubs of only 2 to 5 tons capacity. Modern mechanization is easiest in new shafts working virgin ore concessions which are mainly the reserves of the larger steel companies and which are few in number. At the new Saizerais mine (Fig. 2) 10–12 ton tubs with four-wheel brakes and automatic couplings will be used.

Ore preparation

Blast furnaces operate most satisfactorily when the charge consists of lumps of moderate and uniform size: "blocks" and "fines" in too great a proportion are alike troublesome. Mechanized extraction gives larger blocks of ore and, in Lorraine, the crushing of ore has become indispensable. Unwanted "fines" are thus produced which must in turn be processed by sintering or agglomeration. Crushing plants have been built at almost all mines. Where these plants feed a single works they crush directly to the wanted dimension; in other cases a preliminary crushing is given at the mine and the receiving works crush again in their own plant to the chosen size. Sintering plants have now been built at most Lorraine steelworks. This process is only economical with a large input of fine ore and 7 to 10 per cent of coke breeze must be added to generate enough combustion to make the particles fuse into porous lumps. A location at works is therefore essential. Sintered ore has the advantage of demanding less coke in the blast furnace.

The carbonization of coal

Coke has always been expensive in Lorraine and the best opportunities for improving the commercial strength of the iron and steel industry lie in reducing its cost. One of the most promising ways of achieving this is the application of new techniques for carbonizing coal from the Lorraine coalfield and the Saar. The nearest coalmines in Lorraine are less than 30 miles from the iron and steel works of the Thionville area, whereas the Nord coalfield and Ruhr lie at a distance of over 150 miles. The best grades of coal produced in the Saar and in Lorraine are, moreover, but slightly dearer than Ruhr coking coal at the pithead and cheaper than that of the Nord. The problem is one of coking properties. Saar and Lorraine coal produces good metallurgical coke by orthodox methods only when mixed with 70 per cent of coking coal from other fields, but since the war three new techniques have been evolved for making good coke from a mixture containing

70 per cent or more of Saar–Lorraine coal. It is necessary to erect plant for selective crushing and screening and, in the case of one method, to install a new type of oven. However, allowing for the use of cheaper coals, there is a saving in the cost of coke produced. By the close of 1956 the new techniques had been applied on an industrial scale at six plants. Three of these were existing iron and steel works coking plants (Thionville, Hagondange, Pont à Mousson), one was a new steelworks plant (Serémange) and two were new colliery plants on the Lorraine coalfield (Carling, Mariénau) (Figs. 1 and 2). Coking facilities at Mariénau and Hagondange have since been expanded. Five steelworks coking plants still use orthodox methods but are likely to be adapted to new techniques within a few years. There remain no less than seven integrated iron and steel works which lack ancillary coke ovens. No plans exist for building these and Lorraine is likely to remain dependent, in part, on coke brought in from distant regions. The difficulty of disposing of surplus by-products of coking profitably is one factor in this. In Lorraine only a fifth of the crude steel is produced in open-hearth furnaces and there are few heavy industries

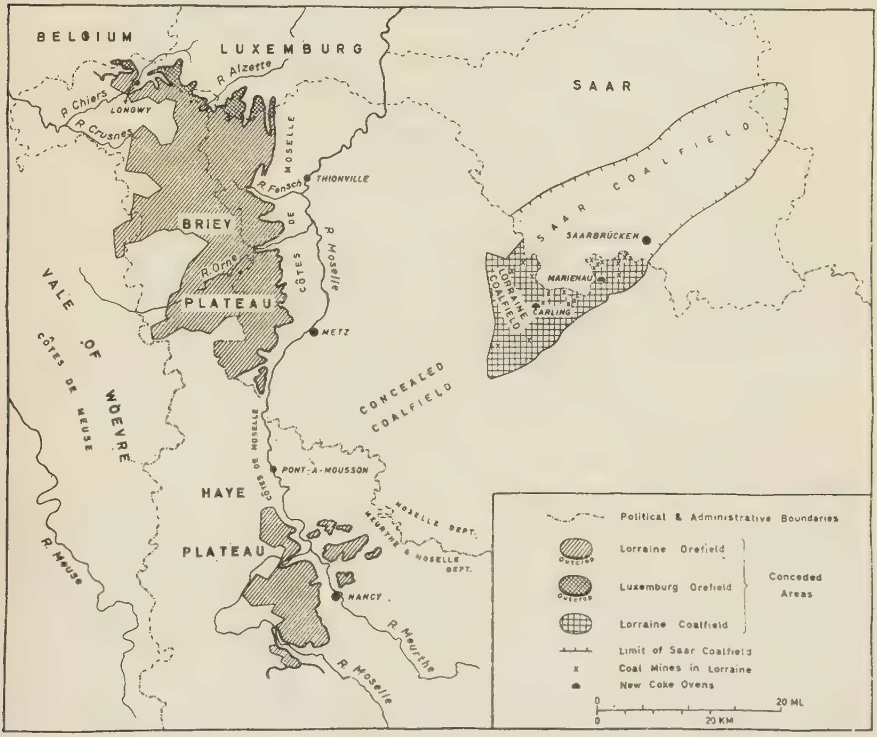

Fig. 1.—The Lorraine ore and coalfields. Conceded areas are those in which corporations own concessions granted by the State, where mineral extraction is permitted. The limits of the Saar coalfield are based on maps in: Institut National de la Statistique et des Études Économiques: *L'économie de la Sarre*, Paris, 1947.

other than steel so that the demand for coke-oven gas is small. This contrasts with the intensive use of gas in the Ruhr and Nord. Surplus gas is delivered to Paris by a recently completed pipeline but it seems improbable this could form as remunerative an outlet as would local industry.

Electricity generation

By the late 'thirties the Lorraine industry had become almost entirely self-sufficient in power, generating electricity from surplus blast furnace gas at each works and distributing it through a private interworks grid. Since 1945 the modernization of rolling and finishing mills, in particular, has already markedly increased the demand for power. This has been matched by the installation of new generating plant with greater thermal efficiency. The most significant achievement has been the construction of two large power stations (Fig. 2) equipped with 40,000 and 55,000 kW generating sets and each linked to four works by gas pipe and electric cable. These stations permit transfers, between works, of energy either as gas or as electricity and, by receiving gas from four works, can operate more regularly than isolated stations. By virtue of their size they also offer a very high thermal efficiency. Only works in large and close aggregations may be served by stations like these because of the high cost of piping blast furnace gas.

Iron and steel production

Lorraine is France's leading region in each stage of the iron and steel industry, producing nine-tenths of its ore, four-fifths of its pig iron, two-thirds of its crude steel and rather over one-half of its finished steel. Lorraine's importance has always been greater in iron than in steel and in crude metal than in finished products. Regional scrap supplies are small and the local market for steel goods is restricted. Traditionally the district has specialized in semi-finished steel and in heavier and cruder products made in basic Bessemer steel.

The modernization programme has laid special emphasis on applying new techniques to the rolling and finishing operations and in this electrification has played a vital role. The largest achievement has been the construction of a new continuous wide-strip mill with hot rolling facilities (at Serémange) and cold-rolling and electrolytic tinning facilities (at Ebange) (Fig. 2). Serémange produced 1 million tons of strip in 1955. Every works, however, has figured to some degree in the programme. There have been at least two cases of recent migration to the region: a cold-strip mill was transferred from Billancourt (Paris) in 1952 and a tinning installation, opened in 1954, replaced one at Bordeaux. The use of an oxygen-enriched blast in the Bessemer converter, now practised at some works, affords hope of an increase in the production of better quality steel.

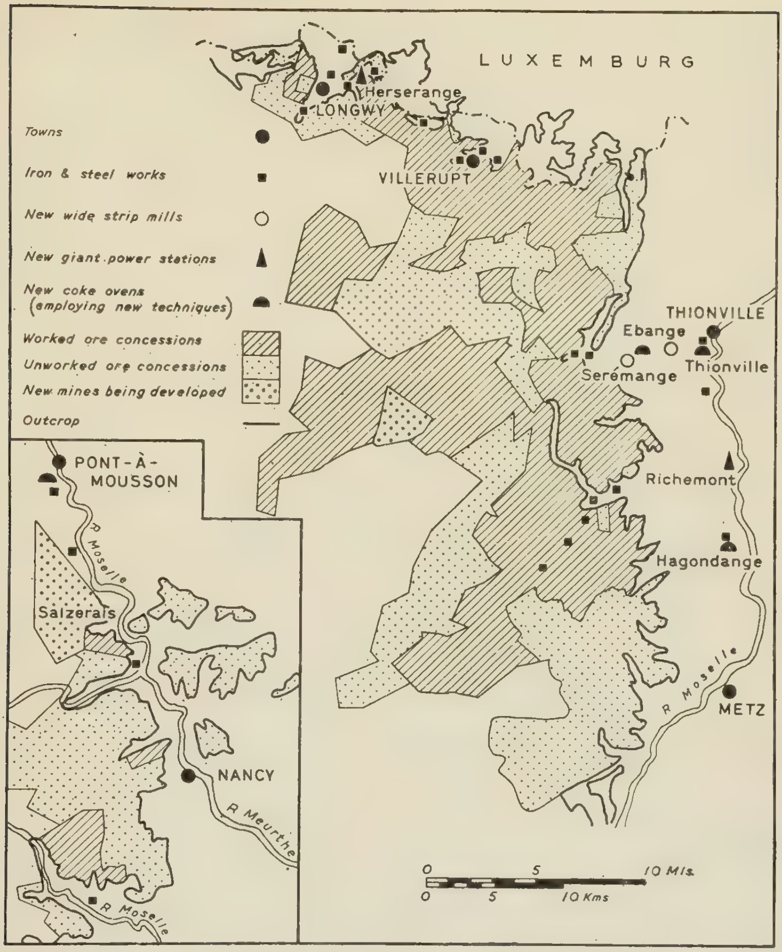

Fig. 2.—The Lorraine iron and steel industry. Acknowledgment is made for permission to reproduce data from the 1 : 50,000 map of the Chambre Syndicale des Mines de Fer de France.

THE INTERVENTION OF THE EUROPEAN COAL AND STEEL COMMUNITY

The Schuman plan came into operation with the opening of the European Coal and Steel Community, fully effective from May 1953. This event presented the Lorraine steelmasters with both danger and opportunity. The actions of E.C.S.C. may be conveniently classified under three headings:—

The abolition of state duties, subsidies and controls which discriminated against foreign goods. Most commonly these measures had aimed to restrict exports and stimulate imports of materials (ore, coal, coke and scrap) and restrict imports and stimulate exports of iron and steel products.

The prohibition of unfair selling systems adopted by producers. It is the aim of the E.C.S.C. to enforce a system under which each producer charges a published basic price and adds to this the actual cost of transport, to a destination, without spatial discrimination. Many previously existing practices were incompatible with this code. Some producers quoted different basic prices for foreign and domestic sales (double pricing); some gave special reductions on sales to markets where competition was keen (alignment rebates); some charged a uniform delivered price to all purchasers in a given region (zonal delivered prices).

The modification of unfair rate schemes imposed by transport agencies. Such schemes were commonly adopted by railways for international freight traffic. They often charged a higher scale of rates than on national traffic or withheld rebates granted to the latter. They generally treated frontiers as starting points in calculating "mileage degression" (i.e. the extent to which charges taper with distance), and also added fictitious "terminal charges" at these points.

Actual changes in commercial conditions brought about by the Schuman plan which directly affected Lorraine's iron and steel industry may now be summarized. The Common Market opened for various commodities between February and May 1953. At that time state quotas were removed from French ore exports and German coal and coke exports, while a French ban on steel imports was also lifted. Other changes made commodities cheaper for foreign buyers within the E.C.S.C. area. Exported French ore was cheapened by the abolition of "double pricing" and of higher French railways' rate schedules; exported German fuel by the suppression of "double pricing" and of state export taxes. The Belgian railways ceased to impose higher rate schedules on coke exported from, or in transit through, Belgium or on steel from foreign sources destined for Antwerp. German and Benelux tariffs on imported steel products were suppressed. French steel companies were forbidden to sell products on their home market at "zonal delivered prices".

At first only the more obvious railway rate discriminations were ended. Until November 1954 the French railways continued to place higher charges on imported fuel. A real approximation of international to internal transport costs was achieved only with the imposition by the Community of "international through rates". These were introduced in two stages, for fuel and ore in May 1955 and 1956, for steel and scrap in May 1956 and 1957.

French state subsidies on imported coke finally disappeared in 1955 and on imported coking coal in 1957. They had been reduced in step with each cut in prices, taxes or freight rates on these commodities.

RESULTS OF RECENT TRENDS

Recent changes in technical and commercial conditions have altered the patterns of spatial variation in cost, both for raw materials and products. The consequences appear in a re-direction of movements of material and in a re-alignment of supply and market areas. Since the inception of the Community, for example, the price of Lorraine iron ore delivered abroad has fallen relatively to its price in France and the Saar. There was an increase in the proportionate flow of ore to Belgium in 1953 and 1954 and this higher Belgian share in deliveries has since been maintained despite the sharp growth in total tonnage sold (Table I). The response to price cuts might have been greater were more trade conducted by open-market sale; in fact most Lorraine ore mines are in the hands of steel companies.

Table I

Deliveries of Lorraine Ore 1952–57

Destination	1952 %	1953 %	1954 %	1955 %	1956 %	1957 %
Lorraine	57·5	60·5	59·2	60·5	60·9	61·7
Rest of France	6·5					
Saar	16·1	16·8	15·5	15·3	15·5	15·3
Belgium	10·0	12·1	13·5	13·9	13·4	12·9
Luxemburg	9·9	10·6	11·8	10·2	10·1	10·1
Germany	Nil	Nil	Nil	Nil	0·1	Nil
Total deliveries in thousand metric tons	38,366	37,956	39,697	48,029	49,591	52,143
Total production in thousand metric tons	37,753	39,464	41,189	46,754	48,895	53,832

Sources:—For 1952: Hauts Fourneaux de Saulnes (Jean Raty et Cie): *Les Mines de Fer Françaises* (1954), 1st edition, appendix. For other years: *Actualités Industrielles Lorraines*, monthly tables.

The pattern of Lorraine's coke receipts has changed markedly (Table II). From 1952 to 1957 the proportion of coke obtained from Lorraine ovens rose from 25 to 39 per cent reflecting the expansion and modernization of coking facilities in Lorraine. The growth of coke oven capacity and output in the region has continued steadily, though in the boom years since 1955 the coke consumption of Lorraine furnaces has risen almost as rapidly. The proportion of Saar and Lorraine coal charged to Lorraine coke ovens has also grown. In 1957 the steelworks' ovens derived 29 per cent of their coal from the Lorraine field and 23 per cent from the Saar, while the colliery ovens were drawing about 70 per cent of their coal from these two sources. Cuts in the delivered price of imported fuel, enforced by the Community, were at first largely offset by subsidy reductions. In the case of coke, however, the benefits have accrued to French purchasers since 1955 and have been particularly large on Ruhr and Dutch coke. It is significant that in 1954 a consortium of Lorraine steel companies purchased the Harpener Bergbau colliery and coke oven properties around Dortmund. While steel firms were glad to acquire coke wherever they could in the years of high production from 1955 to 1956, the continued use of Ruhr coke is clearly anticipated. The canalization of the Moselle from Thionville to Koblenz, whose completion is expected in 1962, should bring Ruhr coke to Lorraine at low cost.

Lorraine steelworks have improved their efficiency and secured commercial gains in recent years. To assess the trend in the region's strength as a steel producer it is necessary to distinguish those improvements not shared by rival producing regions. In these terms the fall in coke costs is the decisive event. The gain for Lorraine is assured, whether from cheaper foreign coke, thanks to E.C.S.C., or from cheaper Lorraine-made coke, thanks to new techniques. Neither the Ruhr nor the Nord, consuming as they do largely local fuel, have derived comparable benefits from the cuts in international freight costs on coal and coke. Since coke represented nearly a third of total costs per ton of steel products in Lorraine in 1954, the gains should be significant in the selling of steel. Some of Lorraine's competitors, moreover, are to lose concessionary freight rates on raw materials from domestic sources. In February 1958 the High Authority declared several rate systems "discriminatory" and ordered their suppression or modification by fixed annual stages. This will mean dearer Ruhr fuel for iron and steel works in Bavaria and the Siegerland region and dearer Normandy and Pyrenean ore for French works, where these materials are received by rail. Ruhr fuel for the Salzgitter works will be dearer both by rail and canal.

Table II

METALLURGICAL COKE SUPPLIES OF LORRAINE IRON AND STEEL WORKS 1952–57

Source	1952	1953	1954	1955	1956	1957
	%	%	%	%	%	%
Lorraine	25·3	29·7	36·3	35·3	37·7	38·6
Lorraine steelworks ovens*	23·7	26·3	29·6	27·5	27·4	28·2
Colliery ovens	1·6	3·4	6·7	7·8	10·3	10·4
Ruhr	41·4	38·8	29·2	36·4	34·3	33·9
Nord and Pas de Calais	13·2	13·6	13·0	11·5	10·8	11·6
Netherlands	6·4	6·3	7·9	8·0	7·6	7·5
Belgium	2·4	2·8	5·7	3·4	3·8	4·2
Saar	6·8	5·9	5·8	3·8	3·7	3·4
Loire	0·3	0·3	Nil	Nil	Nil	Nil
Miscellaneous French Sources	2·5	2·0	2·1	1·6	2·1	0·6
Italy	1·6	0·6	Nil	Nil	Nil	0·2
Czechoslovakia and U.S.A.	0·1	Nil	Nil	Nil	Nil	Nil
Total in thousand metric tons	8080	7064	7090	8932	9493	9846

Sources: Supplied by Bureau de Documentation Minière (B.D.M.). Figures are for receipts except: * Production of large coke (>60 mm.) by steelworks' coke ovens: B.D.M. *Statistique mensuelle*. For 1954–57 the ratio of large coke : total coke assumed constant.

In the market for steel goods within the Community, competition is now fettered only by the natural barriérs of space. The results were at first manifest on the coastal fringe of Western France where Ruhr steel, delivered by the Rhine and sea transport, undercut steel from French sources, including Lorraine, sent by rail. French producers were forced, with the High Authority's permission, to grant "alignment rebates". Since 1955 steel has been in short supply and in 1956 German sales to France were negligible. On the other hand there was in the same year a modest but significant penetration of the South German market by Lorraine and Saar steel producers. The canalization of the Moselle will enable Lorraine to deliver steel products at lower costs to many destinations and, moreover, the boundaries between the market areas of steel-producing regions should in future prove more responsive to cost and price changes. Recent trends appear on balance to have strengthened the competitive power of Lorraine's iron and steel industry.

REFERENCES

Various aspects of the Lorraine iron and steel industry are treated in greater detail in three recent articles:

N. J. G. Pounds, "Historical geography of the iron and steel industry of France," *Annals of the Association of American Geographers*, vol. 47, No. 1, March 1957, pp. 3–14.

N. J. G. Pounds, "Lorraine and the Ruhr," *Economic Geography*, vol. 33, No. 2, April 1957, pp. 149–62.

J. E. Martin, "Location factors in the Lorraine iron and steel industry," *Trans. Inst. British Geographers*, No. 23, 1957, pp. 191–212.

The standard work in French is A. Somme, *La Lorraine métallurgique*, Paris, 1930. Among more recent works the following are important: on the economic problems of the French steel industry, J. Chardonnet, *La sidérurgie française. Progrès ou décadence*, Paris, 1954; on ore mining, Société des Hauts Fourneaux de Saulnes (Jean Raty et Cie), *Les mines de fer françaises*, Paris, 1954; on the social and economic problems of Lorraine, E. Rideau, *Essor et problèmes d'une région française, Houillères et sidérurgie de Moselle*, Paris, 1956.

A geographical survey of the prospects of the European Coal and Steel Community is given in J. A. Coker, "Steel and the Schuman Plan," *Economic Geography*, vol. 28, October 1952, pp. 283–94. Some achievements are summarized in J. H. Paterson, "Progress of the European Coal and Steel Community," *Geography*, vol. xli, April 1956, pp. 129–30. The Community publishes an annual volume in English, *General Report on the Activities of the Community* (April 1953 *et seq.*).

A new production of outstanding interest to geographers is a set of tables of inter-regional flows of commodities in 1956. These will be found in the Community's *Informations Statistiques*, 5e année, No. 1, Jan./Feb. 1958. The figures are to be continued annually.

The progress of the Monnet plan is reviewed in the *Rapport Annuel* of the Commissariat Général du Plan de Modernisation et d'Équipement (1947 *et seq.*).

A clear, technical account of one of the new coking methods will be found in *The Iron and Coal Trades Review*, 30 Dec. 1955, pp. 1599–1602, and useful studies of the Moselle Canal project in the British Iron and Steel Federation's *Steel Review*, No. 4, 1956, and *The Times Review of Industry*, January 1958, pp. 72–4.

The Teaching of Geography in the Secondary Schools of France

L. J. JAY

THE INSULARITY OF THE BRITISH is not to be measured solely in terms of physical features; it is also apparent in the degree to which we are unfamiliar with certain institutions of our nearest neighbours on the mainland of Europe. Thus it comes about that geography teachers in Britain may appreciate the contributions of Paul Vidal de la Blache to the development of the subject at the turn of the century, whilst remaining ignorant of the conditions under which geography is taught in French schools at the present time. An opportunity to focus attention upon this theme is presented by the recent publication of a monthly review which devotes an entire number to the teaching of geography in the secondary schools of France.*

These *Cahiers Pédagogiques* are primarily concerned to provide a vehicle for the exchange of opinions and experiences among teachers in *lycées* and *collèges*, although contributions are welcomed from a wider circle of interested persons such as members of the Inspectorate, lecturers in Training Colleges and Universities. The issue under review considers the extent to which developments in the evolution of geography as a subject for advanced study have influenced the teaching of it in French secondary schools, and upon this theme are presented the opinions of more than thirty different contributors. The compilation, like ancient Gaul, is divided into three parts.

PART I. GEOGRAPHY TODAY; PROBLEMS PRESENTED BY ITS EVOLUTION

The theme is introduced by a survey of geography during the past hundred years. After a phase of elaboration, building upon the foundations laid by Humboldt and Ritter, the present century ushered in a period of expansion in which the contributions of French geographers were both notable and numerous. M. Clozier pays a deserved tribute to the achievements of V. de la Blache and his pupils such as de Martonne, Demangeon, Blanchard and Sion, observing that the preoccupation with regional studies is the most obvious, if not the most profound feature of the French school of geography, although general geography was not lacking attention, as the works of de Martonne and Brunhes testify. This prodigious activity of the French during the first half of this century is symbolized in the 22 volumes of the *Géographie Universelle* which were published between 1927 and 1946. Since the end of the War the work of consolidation has proceeded, in France as in England, with an increasing number of University chairs in geography to indicate the vigorous maturity of the subject.

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* *L'Enseignement de la Géographie.* Cahiers Pédagogiques pour l'Enseignement du Second Degré. 21·5 × 26·5 cm. 104 pp. Paris: Le Comité Universitaire d'Information Pédagogique. February 1958. 300 frs.

MM. Chabot and Faucher devote several pages to the need for geographers to consider the impact of urban and rural ways of life, whilst A. Meynier points out the fundamental ambivalence of geographical research which, by definition, is a synthesis of reciprocal relationships between terrestrial phenomena and yet, of necessity, is also a study involving increasing specialization along narrowing paths. Regional and applied geography, he asserts, are the two aspects which contribute to the essential unity of the subject. At the level of secondary school teaching, however, the emphasis is on regional geography, and Prof. Meynier mentions the dilemma—familiar to English teachers—of combining regional and general geography in the school course. M. Pinchemel comes to the conclusion that the cement which binds geography and its numerous specialisms is the regional synthesis, and it is above all in the secondary schools that this tradition is maintained, although possibly due to inertia rather than as a consequence of deliberate policy. M. Clozier stresses that geography is the science of convergence and synthesis, repeating a phrase of V. de la Blache to the effect that the contribution of geography to the common fund of sciences with which it has contact is the ability not to fragment that which nature brings together.

Then follows a consideration of applied geography, which has made great progress in recent years, although less marked in France than in countries such as Great Britain and the U.S.S.R. M. Tricart examines this at some length, instancing examples of post-war researches by French geographers which have aided administrative, social and economic developments inside France and overseas. On the other hand, a costly road network in French Equatorial Africa and the regulation of the Rhône at Donzère illustrate the dangers of developing projects without invoking the advice of geographers, who are still ignored because for a long time they have been isolated in their ivory towers of purely academic research. There is a need, he says, to inform the educated public of the fundamental conceptions of the new geography.

At the end of this first Part, M. Tricart examines the position of geography in the University system. In France geography occupies an uneasy place in the Faculty of Letters where it is linked with history as a subject for degree studies. Such an arrangement has its complications. It precludes a profitable association with studies such as economics, botany, or meteorology, and moreover it hinders the full and effective treatment of physical geography by virtue of its exclusion from the Faculty of Science, where chairs of Physical Geography can be held by geologists who may lack a truly geographical background. The remedy, in his opinion, lies in modifying the regulations so that a degree course in geography can be followed by studying related subjects other than history. If the Faculty system is retained in all its present rigidity then, asserts M. Tricart, the bridge character of geography, with bases in both the Arts and the Science Faculties, would best be recognized by the creation of Institutes of Geography in each University, on the model of the present one at Paris.

The qualifications demanded of teachers in secondary schools also receive critical treatment. Before the War a thorough knowledge of his special subject was considered sufficient to make a man competent to teach in a *lycée* or *collège*, without the need for a course of professional training. After obtaining this degree (*licence*) a graduate intending to teach would add his name to the waiting list for vacant posts or continue studies at the University for his *agrégation.* This was, and still is, a highly competitive and strenuous examination involving written and oral tests. Success in this (which is a necessary qualification for a lecturer in a University) automatically ensures a post in a *lycée* on the most favourable conditions of remuneration and teaching commitments. A pass in the written part alone merits a salary increase, and graduate teachers can attempt *l'agrégation* year after year until they succeed. A pass rate of under 8 per cent is not unusual, and these *agrégés* form an élite comprising about one quarter of all teachers in *lycées* and *collèges*, where they teach their special subject for 15 hours per week; many combine this with part-time lecturing in a University, for their obligations to the school end with the discharge of the lessons. Since the War the introduction of a course of training after the degree has brought the French system more into line with British practice. All teachers at the secondary level must now possess a certificate of aptitude for teaching in secondary schools (C.A.P.E.S.), which is a competitive examination taken one year after the *licence*, followed by a year of teaching practice and study at a regional teaching centre under the supervision of experienced and highly qualified teachers. Only those for whom teaching posts are available are awarded the C.A.P.E.S. certificate, which is intermediate in status and remuneration between the *licence* and *l'agrégation;* the latter still remains the coveted qualification.

M. Tricart is critical of the course leading up to a degree in geography whereby after one year of general studies for a preliminary examination (*la propédeutique*) the student has to obtain four certificates in history and geography during the ensuing two or more years. This, it is alleged, offers an inadequate course in the advanced study of geography. He therefore proposes two levels of study at the University; a three-year course of geographical studies without the forced yoke with history, leading up to a degree. Beyond this, further study would be directed to teacher-training or to research. One year of the former would qualify for a post in the junior forms of a secondary school, whilst teachers of the upper forms would need to have completed some advanced research in geography along the lines of the existing *agrégation.*

Thus the first part of this survey begins with the emergence of geography and closes with the formation of a geographer; the former is an historical account of what has been, the latter describes what is and what might be. With the exception of M. Clozier, who is a member of the Inspectorate, it is notable that all the contributors to this section are University teachers.

PART II: THE TEACHING OF GEOGRAPHY AT THE SECONDARY LEVEL

Here again there is a lengthy consideration of the nature of geography as a prelude to the circumstances under which it is taught. Suggestions for reform of the syllabus presuppose that the reader is familiar with the organization of education in France at the secondary level, which, as in this country, begins with pupils aged about eleven. The first year in a *lycée* is called *classe de Sixième*, the second is *la Cinquième*, and so on until the sixth year, known as *la Première.* The seventh or top year (*classes terminales*) has sections for philosophy, science and mathematics. An external examination, the *Baccalauréat*, administered by the University, is taken in two parts at the end of the sixth and seventh years of the course, respectively. (To avoid confusion, English equivalents will be used here, so that the *Sixième* is referred to as the first year, etc.) In the *lycées*, which are financed and administered by the State, geography is taught for one or two hours out of the twenty-four per week which are given to each pupil as formal subject lessons. The geography specialist in each *lycée*, who is probably an *agrégé*, will have no concern with the general character-training of his pupils, nor with the social life of the school community, for other officials are employed to deal with administration, finance and discipline. *Collèges classiques* are established and maintained by the municipal authorities, although the curriculum and staff are appointed by the State. In addition, the proportion of *agrégés* to the total complement of teachers will be lower in a *collège* than in a *lycée*. Other types of secondary school are the *collèges modernes*, which before the War were higher-grade elementary schools, and *collèges techniques*.

The seven-year cycle of studies at the secondary level, dating back to the time of Napoleon I when the *lycées* were instituted, has now been split into a first cycle, covering the first four years' work, and a second cycle embracing the last three of the full course. In 1938 the curriculum for the first cycle was standardized for all types of secondary school to facilitate transfer of pupils from one kind of school to another.

In all these secondary schools the syllabus for geography, as for the other subjects of the curriculum, is laid down with precision by the Ministry for each year of the course.* Briefly it is as follows:—

First year: General geography.
Second year: The World excluding Europe and Asiatic Russia.
Third year: Europe excluding France and its colonies.
Fourth year: The French Territories.
Fifth year: General geography.
Sixth year: France and the French Territories.
Seventh year: Great world powers.

It should be noted that geography is studied and examined in every year of the full course, even in the *Baccalauréat*, so that the limited number of subjects studied in the Sixth Form of an English grammar school has no parallel in the *lycée*. Text-books are written for each year of the course and thus the scope and content of each volume varies within certain well-defined limits.

The English teacher may well feel critical of a syllabus in which the programme for each year's work is prescribed in detail, nor are there wanting French teachers who jib at the limitations. M. Bourlet feels that the course is fitted neither to the needs of modern man nor to the potentialities of the pupil. He complains of too much ground to be covered, resulting in a superficial treatment. M. Dreyfus declares that the programmes date from 1902, when regional geography figured prominently in the French school of geographical thought. Although not disputing the importance of this, he feels that the subdivision of France into eleven regions has no significance for the non-specialist, and points out certain anomalies of classification. He is supported by several other correspondents in favouring a return to the single seven-year cycle. Mlle. Pasquier, echoing a plea made a few pages earlier by M. Masset, asks that there should be a better fusing of general and regional geography in the scheme, since the two cannot with justice be segregated into distinct years of study.

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* I am grateful to M. Rougelin, Lecteur in the University of Sheffield, who kindly supplied information on this and on a number of related topics.

To redress the balance, Mlle. Guerrier defends the existing arrangement, arguing that it is always possible to adapt the syllabus to the pupils' level. Her point is amplified by M. Clozier with reference to the first-year programme. The schemes of work followed in the secondary schools of Poland and the U.S.S.R. are then listed for comparison.

In the ensuing discussion of teaching methods we encounter a number of ideas which have been tried in England since the 'twenties, and phrases such as: work from the concrete to the abstract, from the local area around the school to larger regions of the homeland; let the pupils discover facts for themselves; promote activity methods—these have a familiar ring to our ears. M. Bourlet describes some of the difficulties of these practices when classes are large and when there is pressure to complete a fixed syllabus.

PART III. THE WORK OF THE GEOGRAPHY TEACHER

A number of diverse topics are dealt with in this section, under the general title of "*Le métier de professeur de géographie*". Aids to teaching are described in some detail, including sketch-maps, photographs, films, maps and models. To the British teacher the least common is possibly *l'exposé*, which might be rendered in this context as a lecturette or talk, given by the pupil in front of his colleagues. This form of test assumes a significant rôle in the *licence* and *l'agrégation*, and is thus in keeping with the French academic tradition. M. Lefèvre describes with enthusiasm the wider scope offered to the geographer who taught one of the *classes nouvelles*. These new classes, introduced in 1945, were organized by the Secondary School section of the Ministry in an attempt to modify the markedly intellectual character customary in the *lycées*. Beginning with a number of first-year classes and continuing until these pupils reached the end of the first cycle (after which lessons reverted to traditional methods) much of the new teaching in a school was shared by three or four volunteers, in place of the customary subject-teaching by specialists. Although the same syllabus was followed the time-table was re-arranged to permit greater experimentation which included centres of interest, group projects, child study, activity methods and local study. The *Cahiers Pédagogiques* became the official publication of a comparatively small but vigorous association of parents, teachers and administrators, created to disseminate information about this reform movement. Nevertheless, as might be expected in a country where respect for tradition is a potent factor in the development of education, these new classes met with strong opposition from certain quarters, and they were discontinued in 1952 except for a few "pilot" classes.

A documented list of films, records, maps and books which can help the teacher completes the *Cahier*.

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Some repetition appears almost inevitable in such a symposium, and many of the opinions expressed at the beginning of Part II echo those already voiced in the preceding section. The whole work is tidily subdivided into three Parts of approximately equal length, although the last of these assumes Procrustean proportions in the quest for symmetry. Much of this third section contains material relevant to the contents of Part II, to which it might well have been attached by adding IIIA, *Les procédés pédagogiques*, to IIc, *Les méthodes*, and by grafting IIIB, which is a bundle of reports on various classes, on to IIB, where the syllabus for each year of the course is treated in some detail.

Two minor slips were detected; the International Conference of Geography Teachers at Grenoble in August 1957 is incorrectly described as the Fourth instead of the Third, and the last sentence at the bottom of page 57, which ends the last line in the middle of a word, is not completed on the next or any other page.

An English reader of this *Cahier* is struck by its preoccupation with the nature and scope of geography, which is accorded one third of the entire journal. One recalls that in *The Teaching of Geography in Secondary Schools* (I.A.A.M. 4th edition) which was published in this country in 1956, the first two chapters dealing respectively with "The Position of Geography" and "The Aims and Scope of Secondary School Geography," occupy no more than 26 pages in a book of over 500 pages. This concern, shown by the French for the understanding of what geography is, can be more readily appreciated when we remember the prominent place of philosophical studies in their educational system, and also the restrictions which limit a free interpretation of the subject in schools and Universities.

Nevertheless the first Part is probably the easiest for an English teacher to comprehend, because a study of the evolution of modern geography forms part of the training of a specialist teacher. It is the succeeding sections on geography in French secondary schools today which are more difficult to follow, simply because there is no factual statement of the present position; this must perforce be inferred from suggested reforms of the system. Thus, on p. 64, M. Bourlet, teaching in a *collège*, declares, "We have succeeded in getting an excellent episcope but we have neither a place to put it nor a room in which to use it, except one which is constantly used by our science colleagues." Is this, one wonders, typical of the state of affairs? It need not be so, for this *Cahier* is not setting out to present foreigners with a balanced picture of geography teaching in French schools. Rather is it a frank discussion between people with lively and critical minds, and the reader feels that he is overhearing the verbal exchanges at an informal gathering of geography teachers.

We are left with the sobering thought that teachers may know little of the conditions under which their special subject is taught outside their own national or linguistic boundaries. Such details are rarely translated into other tongues, and most studies of Comparative Education have not the space to treat of individual subjects in adequate detail. Nevertheless, acquaintance with such detail can stimulate a reconsideration of our own problems. English teachers of geography may recoil from a system where a set programme must be followed for each year of the school course, yet there is something to be said in favour of a scheme which not only considers a Sixth Form specialist as qualified to lecture to University classes, but what is more, provides the opportunities for him to do so.

This Changing World

EDITED BY G. J. BUTLAND

IRRIGATION SCHEMES IN EASTERN INDIA AND PAKISTAN

The Ganges—Kobadak Irrigation Scheme

The Ganges delta is rightly more generally associated with excessive flooding than with its potentialities as a region ripe for irrigation. Yet the biggest single development scheme at present under construction in East Pakistan is concerned primarily with providing irrigation water at all seasons to an area of 1·8 million acres in the western districts of Kushtia, Jessore and Khulna. Water is to be drawn from the Ganges at Bheramara, close to the Hardinge bridge, to command an area extending eventually to the Sundarbans forest in the south and flanked on the east by sections of the Garai, Kumar and Passur rivers, and on the west by sections of what will be the Ganges canal, running close to the Indian border. While final plans are still being worked out for the southern part of the scheme, considerable progress has been made in canal construction in the Kushtia unit of the scheme, and the power station at Bheramara is completed, although the pumping units are not yet installed.

The aims of this multi-purpose scheme are:

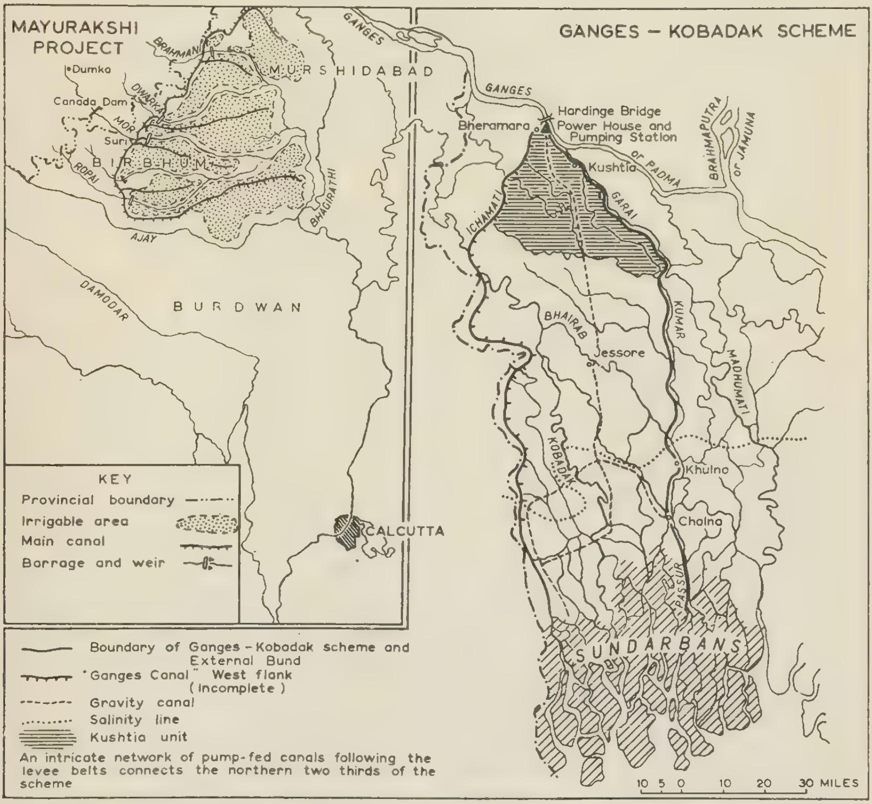
(*a*) To provide perennial irrigation in an area where the annual rainfall averages 56 inches, but may vary between 20 and 120 inches, and is concentrated in the summer months, only 9 per cent falling between November and March. The area lies mainly in the "moribund delta", where rivers act more as drains for local run-off than as distributaries for Ganges flood water. Consequently the crops lack the nourishing floods of rich Ganges water which used to be received here two centuries ago. Irrigation will help to provide plant nutrients as well as moisture.

(*b*) To provide drainage and flood control as a complement to irrigation and to allow the use of the lowest parts of depressions many of which at present remain permanently swampy. By isolating the region from adjacent rivers by embankments, flood control efforts can be focused on the flood water originating locally. Except during the rains there is a back-flow of salt water into the lower parts of Khulna district. The construction of polders with one-way sluices and the provision of fresh water on the surface to suppress the saline ground water is to be undertaken at a later stage. In such areas the cultivation of *rabi* (winter) crops is impossible at present due to salinity, and planting of seeds has to await rains heavy enough to flush the surface soil.

(*c*) To improve communications by both water and road by means of a main north–south gravity canal which will provide all-season through-navigation by country craft, and of a road constructed on the spoil mounds created by the canal excavation.

(*d*) By linking the Bheramara power station with existing generating units near Khulna, to feed into this local power grid surplus electricity for industrial users during periods when the demand for irrigation water in the pump-fed canals is low.

The Bheramara thermal power station (10–12,000 kW) has been constructed to supply a 3500 cusec pumping station on the Ganges bank. Water is lifted 28½ feet at low water, 1½ feet during the floods, into the pump canal at a level of 48½ feet above P.W.D. datum (which is 1·509 feet below mean sea level). The pump-canal system will command 1 million acres mainly in the Kushtia area, and much of the excavation work on the primary canals has been done. Another canal will be cut from Bheramara at a lower level to carry water flowing from the Ganges under gravity to supply 800,000 acres in Jessore and Khulna, and to regulate salinity in the lower reaches of the Kobadak river.



An essential part of the scheme at the present stage is to discover how best the promised water may be used, and to popularize irrigation methods locally. To this end a pilot scheme is operating at Baradi, near Kushtia, providing water to 550 acres of land when the farmers need it. The land-holding system remains unaltered and 366 farmers and 1200 plots of land are involved. Advice and demonstrations are given to farmers on the best cropping system to follow and on other methods of increasing yields. To date, the outstanding achievements are increased rice yields, and a greater use of land during the dry season. It is difficult to establish direct comparisons owing to the paucity and unreliability of earlier data, but transplanted *aman* rice (harvested from December to January), formerly yielding from 8 to 19 *maunds** per acre, with irrigation yields between 27 and 45 *maunds*, the peak being attained by previous use of a green manure crop. Similar ranges of increase are found in the case of *aus* rice sown in March–May, which with irrigation becomes a more certain crop, as land can be cultivated and sown independently of the onset of the rains. The availability of water during the *rabi* season will permit more varied cropping, providing a better balanced diet, a higher cash income, a more even distribution of the labour demand, and improved soil. It is estimated that a five-acre farm at present cropping 6·33 acres (of which only 1·68 is *rabi* crops) will be able to use 8·3 acres, 3·7 of them being *rabi* crops, plus an additional half to one acre of green manure.

In this scheme, Pakistan is being assisted financially and technically by U.N.F.A.O. Colombo Plan and I.C.A. (U.S.A.).

University of Birmingham B. L. C. Johnson.

The Mayurakshi Basin of West Bengal

The Mayurakshi scheme, popularly known as the Mor Project, is a part of India's first Five Year Plan and one of the major development schemes in West Bengal. Though the idea dates from pre-Partition times, work on the Project was not started until 1951 and was completed in 1956.

The Mayurakshi, a hill stream, originates from the Tiur Hills in the Santhal Parganas in Bihar and having a short upland course of about 40 miles reaches the plains of Bengal below Messanjore. The total length of the river from its source to its confluence with the Bhagirathi is about 150 miles and it is the largest of the rivers that run through the area. As its course is through country devoid of any forest cover, most of the rain water quickly runs off into the river. Except in the flood season the river does not carry any appreciable volume of water. During the monsoon months a discharge of 300,000 cusecs is sometimes recorded, whereas its mean discharge is only 2721 cusecs. A storage reservoir was therefore considered to be the only way of conserving water for supply to the fields. Under the Mor Project a multi-purpose scheme was drawn up to combine irrigation, power-generation and flood control.

The ideal dam site was found at Messanjore in Santhal Parganas, Bihar, where the river flows through a narrow gorge cut in the granite and gneiss hills. Named the Canada dam as a token of appreciation of the financial help provided by the Government of Canada, the barrage is 113 feet high above the bed of the river, 2067 feet long, giving a potential storage capacity of over 500,000 acre feet. Four other barrages, one on the Mor at Tilpara

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* 1 maund = 82 lb.

(near Canada dam) and the others on the tributaries, Ropai, Dwarka, and Brahmani, have also been completed, providing a total canal system of about 850 miles in length, mainly for irrigation.

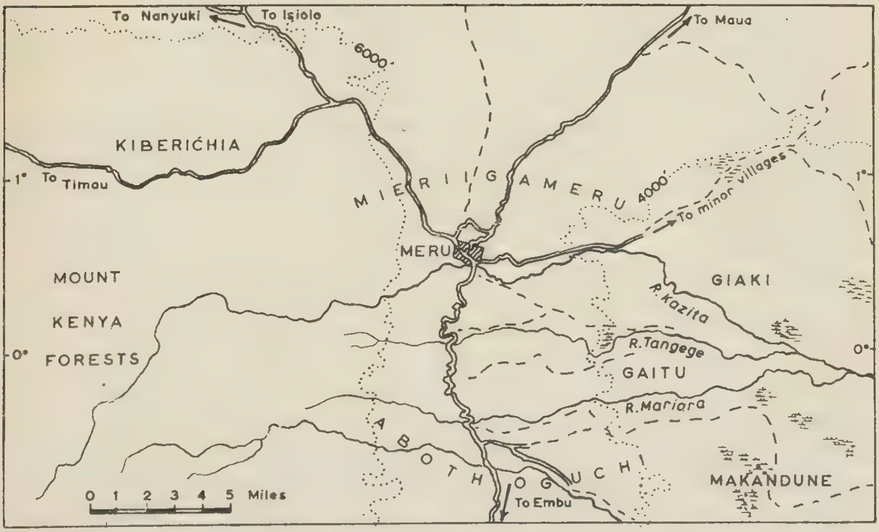
A power project with capacity of 4000 kW is nearing completion at Messanjore on the Canada dam site, and will provide electricity in the upper Mayurakshi basin, for the development of small-scale industries, and the electrification of rural areas and the towns of Dumka and Suri. Additional power of 2000 kW will be available seasonally for lift irrigation to the adjacent areas.

The scheme is an attempt to provide facilities for an area which has had a sad record of periodic crop failures, and besides opening up new areas it will increase the yield from land under cultivation, which is generally low because of inadequate and ill-distributed rainfall. For example, it is estimated that the yield of paddy will be increased by nearly half a ton per acre. (The scale of this increase may be gauged from a comparison of yields on the Kobadak scheme in the accompanying article by Mr. B. L. C. Johnson.) The single-crop (rice) economy of the locality is now gradually being changed into multiple cropping, predominantly of rice, sugar-cane and pulses.

University of Calcutta D. N. MOOKHERJEE.

RESETTLEMENT IN THE MERU DISTRICT OF KENYA

Since the end of the "hot" Emergency in Meru, over-population in the coffee belt has been a hindrance to agricultural improvement in this densely populated area. The Administration has, therefore, set in operation schemes to transfer people to sparsely occupied or uninhabited land. Of necessity this is at altitudes either well above or well below the former homes of potential settlers.



The Kiberichia scheme lies in the higher zone, the altitude range being approximately between 5200 to 8200 feet, where the forest begins. Started in 1955, it aims to bring under cultivation nearly 18,000 acres of former rough grazing and grassland, and already about half the area has been re-settled with new owners. Villages will house the labourers and traders, who will all own at least an allotment of land. The main income derived from farms in this area will be from dairy produce, potatoes and pyrethrum. Co-operative Marketing Societies already deal with bulk sales and assist the farmers with loans.

A different type of settlement is the scheme now centred on Giaki in the lower part of Mieriigameru. Here there were some shifting cultivation rights before the Emergency, but until 1956 this area of rough bush was occupied by game and tse-tse fly. A Headquarters camp beside the Kazita was set up and clearance work commenced prior to demarcation and cultivation. Whereas at Kiberichia 8 to 12 acres was considered an economic holding, 20 acres is the normal size of holding at Giaki. This scheme was at first subject to a certain amount of friction between the sectional interests involved, and consequently progress was less rapid than expected. Conservatism of outlook, however, has now been overcome, and large areas have been freed from tse-tse fly infestation.

In June 1957 the Giaki clearance effort was extended southwards to Gaitu and Makundune in Abothoguchi. In much of the latter swamp clearance was necessary and special attention has been paid to the improvement of road communications. In Gaitu, which has a potential of 9700 acres, settlement has been faster. Landless men from the coffee belt, selected by their committees, were brought in, together with similar numbers of locally selected men, and they have cleared land sufficient for 140 twenty-acre *shambas*. At the same time, this bush clearance drives away tse-tse fly, buffalo and rhinoceros. The area is administered by a Headman specially selected for his educational background and ability. Sites for the village settlement, the school and the dispensary have already been approved.

These schemes have, in aggregate, an enormous food production potential which is an undoubted asset to the district, but it is envisaged that the relief provided for the over-populated belt is, at its best, temporary in view of the continued large natural increase in the population.

Fort Hall, Kenya N. D. McGlashan.
(*written 25th November* 1957)

THE FOREST INDUSTRIES OF NEW GUINEA

The greater part of the Australian Territory of Papua and New Guinea is covered by forests. Though there has locally been substantial human modification of the climax vegetation, leading to the widespread replacement of forest by grass in some densely peopled areas and in drier areas, there remain huge tracts of rain forest which are at least close to the climatic climax. Due to the vigorous relief of the Territory there is an almost complete range of environments, and every variety from mangrove and nipa, through swamp forest, lowland, sub-montane and montane rain forest and mossy forest to Alpine tundra is found. Since the vegetation was described by C. E. Lane-Poole in 1924 (*The Forest Resources of the Territories of Papua and New Guinea*, Parl. Comm. Australia, 1925), at which time the Territory was by no means fully explored and the Highlands were quite unknown, there had been no comprehensive survey until 1957, when a booklet prepared for the occasion of the British Commonwealth Forestry Conference in Australia provided a brief but up-to-date and valuable review (J. S. Womersley and J. B. McAdam, *The Forests and Forest Conditions in the Territories of Papua and New Guinea*, Govt. Printer, Port Moresby, 1957). This booklet contains a number of plates but no maps; it is designed to be read with Map 6 (Natural Vegetation) of *The Resources of the Territory of Papua and New Guinea*, Volume Two—Maps, Ministry of National Development, Canberra, 1951.

The authors call attention particularly to the valuable timber resources in the Territory's forests. Indeed, it is likely that these resources exceed in volume the diminishing total available in Australia itself. Before the war New Guinea walnut was cut by many planters on undeveloped portions of their land, and sold to supplement low copra returns. During the war there was heavy cutting for military purposes, and since 1950 there has been substantial development of both coastal and sub-montane timbers, especially in the Morobe District of New Guinea, around Lae.

The Bulolo valley in Morobe District is an area sparse in native population. Gold was discovered here in 1926 and developed by mining at Wau and Edie Creek and dredging at Bulolo. All materials were flown in, but during and after the war a road was built linking the two towns to the coast at Lae. Lae itself grew up initially as the airbase for the goldfields airlift but has now become a port. In recent years the gold economy has been contracting sharply. Five of six dredges operating in the valley floor at Bulolo have ceased operation and only one major mine remains at Wau. The two companies concerned have been turning their interests to other fields, and particularly to the large timber resources of the surrounding sub-montane forests. Between 2000 and 5000 feet up in the Bulolo valley two species of *Araucaria* and Hoop pine become emergent over wide areas, breaking through the canopy to grow straight up to heights of over 200 feet, often not ramifying for two-thirds of their height. The lower limit is abrupt: the canopy becomes higher and denser, and the *Araucaria* cannot compete unless accidental gaps occur in the canopy.

These *Araucaria* are of value particularly for plywood, and the Commonwealth Government has combined with Bulolo Gold Dredgings to form a new company, Commonwealth New Guinea Timbers, which has invested £A2 millions in a large plywood mill, producing about 10,000 tons of plywood a year and sending this by truck to Lae for export. Road haulage represents some 15 per cent of the total cost, for the road is no smooth highway, yet the company has found it worthwhile to transport veneers made of coastal woods (mainly *Anisoptera* and *Pterocarpus Indicus*) up from Lae to Bulolo for incorporation in the plywood, which is then carried back to Lae. In 1957 the company established a veneer mill at Lae to supply Bulolo. Although the mill may later export veneers, whole logs are now exported, but since the recovery rate is only some 30 per cent of the log, the advantages of raw-material oriented production are obvious. At present the waste of the ply and veneer processes and of the sawmills at Lae and Wau is burned, but it will be used to produce a high quality pulp when the scale of the industry becomes sufficient to make adequate supplies available.

Though there is saw milling elsewhere in the country, particularly of Kamerere (*Eucalyptus deglupta*) in northern New Britain, Bulolo-Lae is at present the only substantial development. There are, however, large resources in other areas. The southern Morobe coast has much *Anisoptera* and in swamp forests of the coastlands of Bougainville and parts of New Britain are large pure stands of *Terminalia brassi*. The Jimmi valley in the northern part of the Central Highlands has extensive stands of Klinki pine, but in a very remote and inaccessible area. A small cutch-extracting industry has been established among the mangroves of the Gulf of Papua, and there are other useful timbers, especially Kamerere and *Octomeles Sumatrana* which form several communities in well-drained areas of secondary forest.

Cutting is accompanied by re-afforestation and forestry research. There are already large plantations of *Araucaria* in cut-over areas in the Bulolo valley, and with the rapid improvement of techniques the rate of planting substantially exceeds the rate of cutting. There is also experimental planting of some coastal timbers in New Britain.

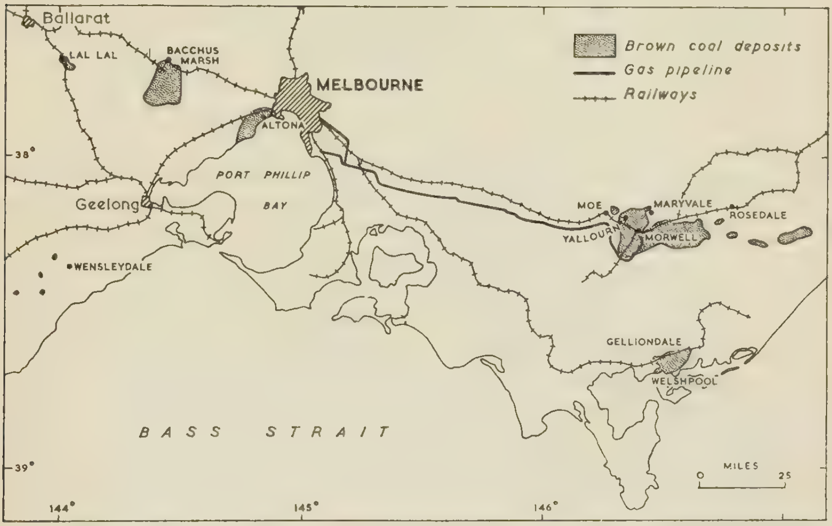
This forestry development provides an interesting illustration of some of the principles governing the establishment of large-scale economic activity in the tropics. It has grown up on a large resource, heavily capitalized, and in an area where the new industry can use existing advantages—roads, towns and other services inherited from the gold industry. This fortunate coincidence has made possible the rapid establishment of the industry in Morobe where production already substantially exceeds £1 million per annum in value. Development elsewhere is likely to be much slower. Furthermore, forest resources in a land of shifting cultivation owe their very existence to sparsity of native population. Labour must be recruited largely from without. Thus the industry must be an alien development and the scale of capitalization and the large land units required for economic operation make it difficult to envisage any infusion of native operation except on the basis of company shareholding, a development that is certainly remote. The direct benefit of the forest industry to the native population derives from the contribution to general revenue and from the multiplier effect of industrial development at Lae, Bulolo and elsewhere. It is only by employment and by the creation of a market for the growing native cash-cropping in the country north of Lae that the benefits are at present diffused among the native population.

Australian National University, Canberra H. C. Brookfield.

THE BROWN COAL INDUSTRY OF AUSTRALIA

Australia, for long the only country outside Europe to use brown coal for electricity generation and briquette manufacture, has recently become the only country other than Germany to make gas from this mineral by the *Lurgi* process. The annual rate of increase in the output of brown coal, which had remained fairly steady since the first systematic exploitation in 1924, is now being accelerated to meet the rapidly growing requirements for the production of briquettes, electricity, gas and by-products, and it is expected that within five years the annual output will have doubled.

Australia has widespread deposits of brown coal but by far the most important are those of Victoria. This state is estimated to possess some 80,000 million tons, of which probably one-half is workable by open-cast methods. The main deposit, which ranges in age from Eocene to Miocene, occupies a fault trough in the Latrobe Valley of Gippsland, 90 miles east of Melbourne. It extends for some 40 miles eastward from Yallourn to Rosedale, varying in width from 5 to 18 miles. This deposit, believed to be the largest continuous occurrence of brown coal in the world, contains more than 22,000 million tons of proven coal suitable for open-cast working.



The ratio of overburden to coal is here generally much more favourable than in Central Europe, and one seam beneath 90 feet of overburden is as much as 760 feet thick. In South Gippsland a field containing more than 2000 million tons, in seams 70 to 100 feet thick, extends from Welshpool to Gelliondale, while west of Melbourne the Bacchus Marsh and the Altona fields have more than 10,000 million tons, though at considerable depth. Smaller deposits occur at Lal Lal, near Ballarat, and Wensleydale.

The development of these resources has been closely related to the local availability of black coal, for in the past brown coal was unable to compete with bituminous coal imported from New South Wales. The first recorded discovery of brown coal was at Lal Lal in 1856, but an attempt to work these deposits in the 'sixties failed through lack of markets. In the Latrobe Valley, where brown coal was first noted in 1874, the initial development met with some success, and until 1899 brown coal was quarried on a site now known as Yallourn North. But a briquette factory established under Government stimulus on the site in 1894 failed five years later. Thereafter private enterprise sought to establish an industry to gasify the coal, but these plans had to be abandoned on the outbreak of the First World War.

In 1916, during a coal strike in New South Wales, the State Government re-opened the old cut at Yallourn North, and the shortage of black coal proved to be so persistent that the quarry was worked (by hand methods) until 1924. That year saw the first mechanized production of brown coal at Yallourn. Despite these developments, the Second World War found Victoria again short of fuel, and the Gelliondale deposit was worked for a while for briquette manufacture. In 1946 the Government declared its intention of enabling "Victoria to become completely and permanently independent of imported fuels" for electricity generation, but this objective has still to be realized. To-day, aside from government development of the Latrobe Valley deposits, those at Wensleydale and Bacchus Marsh are worked on a small scale by private enterprise to supply raw coal to industry.

Although electricity generation remains dependent to some extent on imported fuels, Yallourn is now the hub of power development in Victoria. The brown coal—the name Yallourn, incidentally, derives from two Australian aboriginal words, Yalleen (brown) and Lourn (fuel)—is removed from an open cut now nearing a thousand acres in area at grass level and 900 acres at coal-surface level. The coal seam ranges from 100 to 240 feet thick and averages 200 feet, while the overburden of clay, sand and gravel ranges from 30 to 60 feet thick, and averages 40 feet. The coal contains 65 to 67 per cent moisture but only 2 per cent ash. Although initially the coal was removed by power shovels, dredgers have been used since 1926. Of the 8·2 million tons won in 1957, 5·8 million were delivered to the Yallourn power station, which began operation in 1924, and the rest to the briquette factory, which began producing in 1925 and yielded 620,000 tons of briquettes in 1957. The Yallourn power plant is now the principal one in the Victorian system of 18 interconnected steam, hydro, and diesel power stations. It has an installed capacity of 381,000 kW—to be increased to 621,000 kW by 1962—and generates from two-fifths to one-half of Victoria's electricity. Other Victorian power stations, chiefly those in Melbourne but also at Geelong and Ballarat, use briquettes from Yallourn, so that the Latrobe Valley furnishes, directly or indirectly, two-thirds of Victoria's electricity. By 1963 the annual output of brown coal at Yallourn is expected to reach 11 million tons.

Yallourn North, which was worked intermittently from 1924 until the Second World War, has been in continuous production since 1941. But whereas Yallourn has at least 500 million tons of brown coal awaiting exploitation, Yallourn North has only about 80 million. In 1957 production amounted to 1·6 million tons, most of which was railed to the Newport power station in Melbourne, the rest being sold to industrial users, notably the paper mills at Maryvale.

Morwell, which has twice Yallourn's reserves and lies 6 miles to the southeast, is the scene of most of the present expansion. The area contains vast thicknesses of up to 800 feet of brown coal, but present plans do not envisage going deeper than 320 feet beneath the overburden of 45 feet. Production began on a small scale in 1956, but by 1960 the annual output should reach 2 million tons and by 1965 10 million. The *Lurgi* gasification plant began operating in 1956. Its present annual capacity is 5200 million cubic feet of gas which is piped 102 miles to Melbourne, but capacity will be doubled by 1960 when the plant should supply most of Melbourne's gas requirements. By-products include tar, benzol, and oil. Further expansion in the plant, increasing the present capacity by more than tenfold, is planned for the period 1960–75. The first briquette factory at Morwell, which will have an annual capacity of 714,000 tons, will begin producing in 1960, and the second, with a capacity of 850,000 tons, in 1961. They will supply briquettes to the gas works, to power stations in Melbourne and provincial cities, and to industrial and domestic consumers. The Hazelwood power station at Morwell will start generating electricity in 1959, with an installed capacity of 42,000 kW. By 1961 this will have been increased to 91,000 kW and by 1963 to 151,000 kW.

These developments are markedly changing the settlement pattern of the Latrobe Valley. The town of Yallourn was planned by the State Electricity Commission at the time of the initial developments in the 'twenties; it now has a population of 5500. Nearly a thousand of those who work at Yallourn live in houses built by S.E.C. at Newborough and Yallourn North, and several hundred more occupy Housing Commission homes at Moe. Yet it is Morwell that presents the most striking growth, for since the close of World War II, when Morwell was a rural service centre with 3000 inhabitants, its population has quadrupled. Moreover, within a 15-mile radius of its central business area are more than 45,000 people, many of them New Australians.

Finally, it is worthy of note, particularly in view of current developments in East Germany (see *Geography*, vol. 38, 1953, pp. 18–29, and vol. 41, 1956, pp. 192–5), that a laboratory technique for making metallurgical coke from Latrobe Valley brown coal has been perfected at Melbourne University. A small experimental coking plant has been built at Morwell, and if this should prove successful, much greater developments in the brown coal industry will become possible. Victoria might then be in a position to reduce its dependence on New South Wales not merely for bituminous coal but for iron and steel as well.

University of Tasmania PETER SCOTT.

The Geographical Association

APPOINTMENTS

Professor D. L. Linton, of the University of Sheffield and Honorary Editor of the Association, has accepted an invitation from the University of Birmingham to succeed Professor R. H. Kinvig who retires from the Chair of Geography in that university in September this year.

Professor R. E. Dickinson, of the University of Syracuse, has been appointed to the Chair of Geography in the University of Leeds.

Mr. H. R. Wilkinson, senior lecturer in geography at the University of Liverpool, has been appointed to the Chair of Geography in the University of Hull, in succession to the late Professor H. King.

Dr. M. J. Wise, Sir Ernest Cassel Reader in Economic Geography at the London School of Economics and Political Science and a member of the Editorial Board of *Geography*, has been appointed to the Chair of Geography in that college, from which Professor L. Dudley Stamp retires in September this year.

ABSENCE OF THE HONORARY EDITOR, 1958–9

During the coming session Professor Linton will be on leave of absence from the University of Birmingham in order to fulfil two assignments in the southern hemisphere. The first is to make a voyage with R. R. S. Shackleton to some of the bases of the Falkland Islands Dependencies Survey in Grahamland as the first stage in the preparation of a memoir on the geomorphology of the area, based on some 15,000 air photographs taken by Hunting Aero Surveys in the seasons 1955–6 and 1956–7. The second is to be William Evans Visiting Professor in the University of Otago at Dunedin, New Zealand, for the two terms beginning March 1959. Provision has been made for the discharge of the duties of the Honorary Editor by his colleagues of the Editorial Board, which has been further strengthened by the appointment of Dr. Harry Robinson of Huddersfield Technical College.

ANNUAL CONFERENCE, 1959

The dates of the next Annual Conference, which will be held at the London School of Economics, are from 30th December 1958 to 2nd January 1959. The programme will be sent to all members, without application, in November; it will give full details of lectures, section meetings and business meetings. Facilities for the accommodation of members will be available at Campbell Hall and information about making reservations will be given in the programme.

ANNUAL SUBSCRIPTIONS

Annual subscriptions are due for renewal on 1st September for the following year to 31st August 1959. This applies to full members (£1 1s. subscription), student members, whether for *Geography* or the library (10s. subscription), and schools and colleges which subscribe at the special rate of £2 2s. for extra library facilities. Prompt payment, using the renewal form enclosed with this issue, will speed the completion of the revision of headquarters records and save postage on further reminders. The November issue of *Geography* is sent only on paid-up subscriptions.

CHANGES OF ADDRESS

All members are requested to inform headquarters office as early as possible when they change their address or discover errors in addresses on the envelope of *Geography* sent to them.

ACKNOWLEDGMENTS

Grateful acknowledgment is made of generous grants towards the cost of illustrating articles in recent issues of *Geography* from the Universities of London (Birkbeck College), Birmingham and Liverpool.

BRANCH NEWS

Activities have been successfully revived in the Crewe and Nantwich Branch; members of the Association living in that district can obtain the programme from the secretary, Mr. G. S. Hall, County Grammar School, Ruskin Road, Crewe.

The third volume (1958) of *Panorama* has been published by the Isle of Thanet Branch. It includes short articles on six different parts of the world as well as notes on local geography, results of branch research projects—local climate, meteorological variations, a spring survey—and reports of branch field excursions abroad and at home.

WATER AND CONTOUR MAP PULLS

All members who have ordered special O.S. map pulls through the Geographical Association will wish to record their thanks to Mr. N. K. Horrocks, of Manchester Central Grammar School, who has acted as Maps Officer for the past eight years and has organized the water and contour pulls order scheme. Retiring from this office, he has handed the organization of the maps orders to Mrs. J. Felkin, senior clerk of the Association. In future all orders and correspondence concerning water and contour pulls should be addressed to her at headquarters office.

NEW ZEALAND GEOGRAPHICAL SOCIETY

SECOND TRIENNIAL CONFERENCE, AT CHRISTCHURCH, 1958

Mr. L. S. Suggate, President of the Geographical Association in 1955, who emigrated to New Zealand eighteen months ago, is continuing his activities in the interest of geography teaching by acting as general secretary of the Second Triennial Conference of the New Zealand Geographical Society. To this meeting of N.Z. teachers of geography which will be held at Christchurch at the end of August 1958, the Council, on behalf of the members of the Geographical Association, has sent cordial greetings and good wishes for the continuing success of its sister organization.

INTERNATIONAL CONGRESS OF THE HISTORY OF THE DISCOVERIES

From the 7th to 15th August 1960 an International Congress of the History of the Discoveries will be held in Lisbon as part of the celebrations of the fifth centenary of the death of Prince Henry the Navigator. The principal themes for discussion will relate to the maritime discoveries and overseas expansion. Papers are invited by the organizing committee from anyone interested in submitting contributions. Applications from contributors or from any person who may wish to participate in the Congress should be sent to Professor J. Caeiro da Matta, Secretário-Geral do Congresso Internacional de História dos Descobrimentos, Palácio de S. Bento, Lisboa, Portugal. Headquarters office of the Geographical Association would be glad to learn of any members who plan to attend this congress. Circular no. 1 is already available.

LIBRARY ANNOUNCEMENTS

PERIODICALS IN THE ASSOCIATION'S LIBRARY

The classified lists of articles in geographical periodicals in the Library have been a feature of *Geography* (in two issues a year) since 1924. In the current volume exceptionally long lists are published in order to clear arrears of titles in many foreign journals not previously listed in the past few years. Even these extended lists are not, however, exhaustive—there are many more articles in journals held in the Library for which space cannot be found in these pages. Because the Association's collection of geographical periodicals both in English and in foreign languages is a rare asset to its Library and since it offers a valuable source of bibliography for geographical research and background material for teaching, the library staff is compiling a card-catalogue (for consultation at headquarters) of articles, which will include both the articles mentioned in *Geography* and those which are excluded from the published lists. It is also planned to help teachers and students seeking periodical references by preparing a loan-set of books of cuttings of the article lists published in *Geography* from 1946 onwards. These article bibliographies, which should be available for loan to members by post by the end of this year, will in each case contain references on one major topic or continent, and will greatly simplify the task of searching for titles on specific topics.

The third part of the Association's Library catalogue—covering North and Latin America—will be published by the end of 1958.

Reviews of Books

With very rare exceptions books reviewed in this journal may be borrowed from the Library by full members and student library members of the Association.

The Canadian Oxford Atlas of the World. 39 × 26·5 cm. Part I, Canada. E. G. Pleva, Advisory Editor. 20 map plates + viii pp. gazetteer. Part II, The World, edited by Sir Clinton Lewis and J. D. Campbell, assisted by D. P. Bickmore and K. F. Cook. 96 map plates + xxiv pp. distribution maps + 93 pp. gazetteer. Toronto: Oxford University Press. 1957. 90s.

This new edition of the Canadian Oxford Atlas is a marked improvement on the old, both in design and execution, and a more effective classroom or reference atlas. It is really two atlases in one, first an atlas of Canada, with general and regional maps followed by a thorough gazetteer, and then a world atlas, with separate regional and world maps and a second gazetteer. Under the distinguished editorship of Professor Pleva of the University of Western Ontario the Canadian section has come to reach maturity as an atlas for advanced study. It begins with an excellent set of general maps, of which the climatic maps by Morley Thomas, the rendition of the new geological map by the Canadian Geological Survey, and the resources map by Professor Ruggles are quite outstanding. The geological map has the first representation in any atlas of the great arctic system of fold mountains, known as the Innuitias, discovered just after the war. One regrets, however, the representation of relief in the population map and the general map of Canada. The modelling is too strong for the lesser heights, making the Torngats, the Labrador uplands, and the Laurentides appear as massive and indented as the Mackenzie, Rocky and Columbia mountains. Parts of the Shield, particularly in Keewatin, are distinctly overemphasized, while even the Toronto region is made to look quite rugged. On the other hand the relief of the regional plates has been distinctly improved, the rather weak colours of the early edition having been replaced by stronger, clearer and more pleasing ones.

The regional maps now make much more of Canada. The former plates on Eastern, Central, and Western Canada, and on the Great Lakes area did not do justice to the country. The three major regions are still observed—with a new map of Western Canada which for balance, simplicity and clarity is a sheer delight. But in addition there are new plates on Ontario itself, on the St. Lawrence–Lower Great Lakes lowlands (from Montreal to Hamilton), on the three Prairie provinces, and on British Columbia. These are all carefully compiled and have a wealth of information. If anything, they are overcrowded, especially those of the Maritimes, Central Canada, Ontario, and the St. Lawrence Lowlands where the addition of county boundaries and county names has in many cases cluttered up the map and made it less attractive even though more useful.

Unfortunately what is Canada's gain is, in part at least, America's loss; the new space devoted to the western provinces has halved that given to the western states of U.S.A. One would have thought that the former excellent two-page spreads on the Middle West and the Far West should have been retained in any Canadian atlas and that, where a saving of space had to be made, it could have been taken from Africa, which has many more large-scale regional maps than are normally of interest to Canadian students. One must be thankful, however, that the world general maps were not sacrificed. Made by or under the supervision of Professor D. L. Linton these have been the outstandingly original contributions of the new Oxford atlases. In this edition they have been improved, the salinity of the sea and other oceanographic information having been added, and an effective change of colouring in the population map and in the maps of structure having been introduced. The new double-page map of the structure of Britain, surely the most telling one produced to date, is particularly welcome. No serious student of Canada, of its homelands in Western Europe, of its neighbours in the New World, and of its growing significance in the world, can afford to be without this atlas.

J. W. W.

Europe and its Borderlands. A. G. Ogilvie. 18·5 × 24 cm. 340 pp. London: Thomas Nelson and Sons Ltd. 1957. 42s.

This is no ordinary regional geography. It is a study of Europe and the Mediterranean lands as the theatre of western civilization, published posthumously (under the supervision of C. J. Robertson) and embodying the fruits of lifelong work and reflection. It is a book to read and to provoke thought rather than a source of facts. As such it can be recommended both as an introduction and as a culmination to the study of European geography. A wide range of topics is discussed with a strong regard for historical perspective. There is no extended regional treatment and no bibliography, because they are not necessary to a work whose main contribution lies in its theme. The whole book—text, illustrations and statistics—has been carefully edited and produced.

A. J. H.

L'Europe du Nord et du Nord-Ouest. Vol. I: Géneralités physiques et humaines. A. Guilcher and J. Beaujeu-Garnier. 258 pp. 1200 fr. (paper bound). **Vol. II: Finlande et Pays Scandinaves.** G. Chabot. 371 pp. 1800 fr. 18·5 × 24 cm. Paris: Presses Universitaires de France. 1958.

These two volumes (to be followed by a third on the British Isles and Low Countries) belong to the *Orbis* series of introductory regional geographies edited by André Cholley. Vol. I deals with basic physical aspects (physiography, hydrology, climate, seas, marine life and vegetation) and population (peopling of the area, growth and movements of population). Vol. II contains a fuller account of the morphological evolution of Fennoscandia, with separate chapters on the general economic geography of Finland, Norway, Sweden, Denmark and Iceland. The two volumes are similar in both plan and treatment to their predecessors in the *Géographie Universelle* series. Like them, they are concerned essentially with the adaptation of economic life to physical environment. Changes in the landscape as such resulting from settlement and human activity (rural settlements, field patterns etc.) are not considered. In short a traditional "human" approach is used with up-to-date material, abundant illustration and comprehensive annotated bibliographies in a lucid and well-informed account of economic life in the north-western European setting.

A. J. H.

Irish Folk Ways. E. Estyn Evans. 14 × 22 cm. xvi + 324 pp. London: Routledge and Kegan Paul. 1957. 35s.

To write such a book as this one needs to travel the Irish countryside and coast for thirty years and linger with its folk and use their tools. One must find where its Mesolithic people fished and where and how its first farmers tilled the soil and buried their dead. One must search above and in the bogs for the work of farmers of later centuries, and the evidence of former and present customs must be recorded in the field with a remarkably acute eye and expressive pencil. Finally, in the study, all must be analysed and described with wisdom, affection and zest. Only Professor Evans, with his deep understanding of the Irish people and their background, could have written this splendid book. It is the fruit of pioneer work in both Irish folk life and archaeology, of wide reading of early surveys of Ireland, and of comparative study of many European peasantries.

The introductory chapters describe the changing landscape and the main settlement and field patterns. The following chapters on farmsteads and their contents and yards are illustrated, as is most of the book, by widely-spaced Irish examples and pertinent quotations from other observant investigators such as Arthur Young. Perhaps the most outstanding section of the book is that dealing with ploughs and spades, with methods of cultivation and with the harvesting of both crops and bogs. Later chapters describe the seashore and Irish boats and their fishing gear, and the final ones rural festivals and ceremonies.

The illustrations include excellent half-tones, notably nine from the collection of the late R. J. Welch, and nearly a hundred of the author's line drawings. The publishers rightly claim that this is a work of great charm. It discusses a people who reflect the charm of a simple life and appreciate good craftsmanship. Their farming, fishing and festivals embody old traditions and here we have a full interpretation which draws on both the present and past. The Irish folk are fortunate in their interpreter.

M. D.

The Geography of Air Transport. K. R. Sealy. 12·0 × 18·5 cm. 207 pp. London: Hutchinson's University Library. 1957. 10s. 6d.

This is a welcome contribution to a very useful series. It is packed with information soundly based on statistics and technical data, and illustrated by sixteen maps and diagrams. The subject is treated broadly: the cartographic, climatic, technical and economic background in part I, and geographical aspects in part II. The latter includes analyses of world air routes, air transport in Europe, U.S.A. and under-developed areas and a discussion of airport location. The paucity of geographical references in the bibliography is sufficient evidence of the need for a work of this kind, and more like it.

A. J. H.

MISCELLANEOUS PUBLICATIONS

Information on Steel

The British Iron and Steel Federation has recently published a *Review of the British Steel Industry*, combining a summary text with a large number of photographs which illustrate graphically many of the processes of steel production and what steel works look like. For children who never have the opportunity to visit a steel-producing area, this booklet is an admirable illustrated "guide". The Federation, whose address is Steel House, Tothill Street, London S.W.1, also publishes *Steel Review* quarterly, which frequently contains both useful information and illustrations. No. 11 (July 1958) for instance contains articles on labour in the steel industry and on the siting of British steelworks, both supported by statistical tables and diagrams.

The St. Lawrence Seaway

The *Journal of Commerce* (which is a daily shipping newspaper) published on 25th July a special supplement on the St. Lawrence Seaway, which, when it is opened next spring after the break up of the ice on the St. Lawrence river, will link ocean transport with the inland waterways of Canada and the U.S.A. The 56-page magazine describes the route of the seaway, the engineering feats involved in building it, the effects of the seaway on river ports, and publishes many new photographs and diagrams. It is a useful source of up-to-date information on the new geography of this part of North America.

MILLS IN LOCAL GEOGRAPHY STUDY

A series of booklets on wind- and watermills is being published by the Society for the Protection of Ancient Buildings. Titles now available are *Water Mills* by P. N. Wilson, *Tide Mills*, parts I and II by R. Wailes and part III by E. M. Gardiner, and *Fulling Mills* by R. A. Pelham. In size 14 × 21 cm., they cost 3s. each (post free) except the last which is 3s. 6d. They can be obtained from the Secretary, Wind and Watermill Section, The Society for the Protection of Ancient Buildings, 55 Great Ormond Street, London W.C.1.

The authors describe individual mills, giving a summary of their history whether or not they are still in use. Photographs and drawings are used in illustration. Part III of *Tide Mills* deals specifically with the Three Mills at Bromley by Bow on the river Lea, Essex. Dr. Pelham, who is lecturer in geography in the University of Southampton, in *Fulling Mills* gives a study in the application of water power to the woollen industry in England and Wales and provides an interesting illustrated survey of methods. The Society hopes to publish booklets on paper mills, monastic mills, Arkwright's cotton mill and the fulling mills of Wales.

THE *Financial Times* SURVEYS

A source of up-to-date material, especially of economic interest, is to be found in the supplements published by the *Financial Times*. These Surveys of 40 to 80 pages are frequently concerned with topics of interest to geographers and carry photographs, diagrams and tables as well as authoritative articles. Recent issues, for instance, have been on Canada, Sweden, Belgium and the Congo, Rhodesia, The New Europe, U.K. Shipping and Ports, Metals in Industry and World Oil. About 20 Surveys are published in a year, always along with a Monday issue of the *Financial Times*, which can be obtained through newsagents, price 4d.

M. O.

BOOKS RECEIVED BY THE GEOGRAPHICAL ASSOCIATION

Bibliographie Géographique Internationale 1954–5. International Geographical Union and Unesco. Paris: Centre National de la Recherche Scientifique. 1958. 54s.

TRAVEL AND EXPLORATION

From the Ends of the Earth. An Anthology of Polar Writings. Augustine Courtald. 423 pp. London: Oxford University Press. 1958. 21s. Passages from the writings of travellers to the Polar regions from the eighth century B.C. to the 1930's.

Australian Explorers. A Selection from their Writings with an introduction by Kathleen Fitzpatrick. The World's Classics series. 503 pp. London: Oxford University Press. 1958. 9s. 6d.

Richard Hakluyt: Voyages and Documents selected with an introduction and a glossary by Janet Hampden. The World's Classics series. 471 pp. London: Oxford University Press. 1958. 8s. 6d.

The Travels of Marco Polo translated and with an introduction by Ronald Latham. Penguin Classics L.57. 351 pp. Harmondsworth: Penguin Books. 3s. 6d.

The World Unveiled. The Story of Exploration from Columbus to Livingstone. P. Herrmann. Translated from the German by A. Pomerans. 507 pp. London: Hamish Hamilton. 1958. 42s. Illustrated by photographs, maps and drawings.

PUBLICATIONS OF THE HAKLUYT SOCIETY: SECOND SERIES

Vol. XCIX. *Further English Voyages to Spanish America* 1583–1594. Trans. and ed. by I. A. Wright. 1951.

Vol. C. *The Red Sea and Adjacent Countries at the Close of the Seventeenth Century as described by J. Pitts, W. Daniel and C. J. Poncet.* Ed. by W. Foster. 1949.

Vols. CI and CII. *Mandeville's Travels.* Texts and translations by M. Letts, vols. i and ii. 1953.

Vol. CIII. *The Historie of Travell into Virginia Britania* (1612) *by W. Strachey.* Ed. by L. B. Wright and V. Freund. 1953.

Vols. CIV and CV. *The Roanoke Voyages* 1584–1590. Documents to illustrate the English voyages to North America under the patent granted to Walter Raleigh in 1584. Ed. by D. B. Quinn. Vols. i and ii. 1955.

Vol. CVI. *South China in the Sixteenth Century.* Narratives of G. Pereira, G. da Cruz and M. de Rada, 1550–1575. Ed. by C. R. Boxer. 1953.

Vol. CVII. *Some Records of Ethiopia,* 1593–1646. Trans. and ed. by C. F. Beckingham and G. W. B. Huntingford. 1954.

Vol. CVIII. *The Travels of Leo of Rozmital through Germany, Flanders, England, France, Spain, Portugal and Italy,* 1465–1467. Trans. and ed. by M. Letts. 1957.

Vol. CIX. *Ethiopian Itineraries circa* 1400–1525. Ed. by O. G. S. Crawford. 1958.

Vol. CX. *The Travels of Ibn Battuta* 1325–1354. Trans. and ed. by H. A. R. Gibb. Vol. i. 1958.

The Hakluyt Society publications are now produced by the Cambridge University Press.

NORTH AMERICA

Atlas of Paleogeographic Maps of North America. C. Schuchert. xi pp. + 84 maps. New York: John Wiley. London: Chapman and Hall. 1955. 38s.

Studies of North-West American Forests in relation to Silviculture in Great Britain. R. F. Wood. Forestry Commission Bull. No. 25. 42 pp. London: H.M.S.O. 1955. 6s.

La Vérendrye. Fur Trader and Explorer. N. M. Crouse. 247 pp. Ithaca: Cornell Univ. Press. London: Cumberlege. 1956. 32s. Canadian exploration in the 1730's.

Black Gown and Redskins. Adventures and travels of the early Jesuit missionaries in North America 1610–1791. E. Kenton (ed.) 527 pp. London: Longmans, Green. New edition 1956. 25s.

Rideau Waterway. R. Leggett. 249 pp. Toronto: Univ. of Toronto Press. London: Cumberlege. 1955. 40s.

The Urban Development in South Central Ontario. J. Spelt. 241 pp. Socio-geographical studies of University of Utrecht No. 2. 1955. f.20.

Conserving Natural Resources. Principles and Practice in a Democracy. S. W. Allen. 347 pp. New York: McGraw-Hill. 1955. $5.50. Soil, water, forests, animals, mineral and human resources of the United States and their significance in the national economy.

American Commodity Flow. E. L. Ullman. 216 pp. Seattle: Univ. of Washington Press. 1957. $4. A geographical interpretation of rail and water traffic, based on principles of spatial interchange.

Snow Cover and Climate in the Sierra Nevada, California. D. H. Miller. Univ. of California Publ. in Geography, Vol. 11. 218 pp. Berkeley: Univ. of California Press. 1955. $3.

Climatology of Summer Fogs in the San Francisco Bay Area. C. P. Patton. Univ. of California Publ. in Geography, Vol. 10, No. 3. 88 pp. Berkeley: Univ. of California Press. 1956. $2.

The Spatial Structure of Economic Development in the Tennessee Valley. J. R. P. Friedmann. Univ. of Chicago Dept. of Geography Research Paper No. 39. 187 pp. 1955. $3. A study in regional planning: part I spatio-economic foundations; part II regional planning.

Water Utilization in the Middle Mississippi Valley. M. G. Zadrozny. Univ. of Chicago Dept. of Geography Research Paper No. 45. 119 pp. 1956. $3.

Regional Changes in Corn Production in the United States from 1909 *to* 1949. A. Grotewold. Univ. of Chicago Dept. of Geography Research Paper No. 40. 78 pp. 1955. $3.

Occupance in the Upper Deschutes Basin, Oregon. S. D. Ericksen. Univ. of Chicago Dept. of Geography Research Paper No. 32. 139 pp. 1953. $3. Livestock production, agricultural cropping and the lumber industry; includes descriptions of type-farms and lumber company, with plans of farms, lumber mill and timber lands.

The Port of Milwaukee. E. Hamming. Univ. of Chicago Dept. of Geography Research Paper No. 26. 162 pp. 1952. $3.

The Port of Chicago and the St. Lawrence Seaway. H. M. Mayer. Univ. of Chicago Dept. of Geography Research Paper No. 49. 283 pp. 1957. $3.
Rural Occupance in Transition. D. E. Christensen. Univ. of Chicago Dept. of Geography Research Paper No. 43. 160 pp. 1956. $3. Farm practice and types in Lee and Sumter counties, Georgia.
The Everglades Agricultural Area. R. N. Ford. Univ. of Chicago Dept. of Geography Research Paper No. 42. 127 pp. 1956. $3. Resources and land use in Florida.
The Water Resources of the Lower Colorado River Basin. J. M. Khalaf. Univ. of Chicago Dept. of Geography Research Paper No. 22. Vol. I, 234 pp. Vol. II, 15 folded maps. 1951. $3.
Human Adjustment to Floods. G. F. White. Univ. of Chicago Dept. of Geography Research Paper No. 29. 225 pp. 1945. $3. A geographical approach to the flood problem in the United States.

LATIN AMERICA

The Ancient Civilizations of Peru. J. A. Mason. 330 pp. Pelican Books A395. Harmondsworth: Penguin Books. 1957. 6s.
Farming and Farmlands in Panama. L. E. Guzman. Univ. of Chicago Dept. of Geography Research Paper No. 44. 137 pp. 1956. $3. Includes studies of individual farms and farm plans. *Roza* (rice), cattle, banana and coffee.
Anapolis, Brazil. R. L. Carmin. Univ. of Chicago Dept. of Geography Research Paper No. 35. 172 pp. 1953. $3. Regional capital and railhead city on an expanding agricultural frontier. Includes a study of the towns and cities of Brazil.
The Conquest of Fitzroy. M. A. Azema. Trans. K. Chorley and N. Morin. 238 pp. London: Andre Deutsch. 1957. 21s. Account of the French Expedition to Mount Fitzroy, Patagonian Andes, 1952.

AUSTRALASIA AND THE PACIFIC

Focus on Adelaide. E. M. Bjorklund. Univ. of Chicago Dept. of Geography Research Paper No. 41. 133 pp. 1955. $3. Functional organization of the Adelaide Region.
Work and Life on Raroia. B. Danielsson. 244 pp. London: Allen and Unwin. 1956. 25s.
Ancient Voyagers in the Pacific. A. Sharp. Pelican Books A404. 240 pp. Harmondsworth: Penguin Books. 1957. 3s. 6d. Lengthy bibliography.
Exploring the Pacific. L. F. Hobley. Methuen's Outlines Series. 71 pp. London: Methuen. 1957. 10s. 6d. Junior library book: many sketch maps and helpful line illustrations.

POLAR REGIONS

Geography of the Northlands. G. H. T. Limble and D. Good (ed.). American Geographical Society Special Publication No. 32. 534 pp. London: Chapman and Hall. 1955. 84s. A survey of the physical conditions, economic resources and cultures of the arctic and subarctic regions: Alaska, Canada, Greenland, Iceland, Scandinavia, U.S.S.R.
The Last Kings of Thule. J. Malaurie. Trans. G. Freeman. 295 pp. London: Allen and Unwin. 1956. 21s. The record of a year among the Polar Eskimos of Greenland.
Greenland. K. R. Therkilsen. 123 pp. of photographs and captions. London: Duckworth. 1953. 30s. An excellent photographic record of many aspects of present-day life and settlement in Greenland.
Glacier Island. G. Sutton. The official account of the British South Georgia Expedition 1954–5. London: Chatto and Windus. 1957. 21s.

Geographical Articles

Listed from Periodicals received in the Library

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Journals listed here may be borrowed from the Library by members of the Association. References are listed according to the classification published in the *Annals of the Association of American Geographers*, vol. xxvii, June 1937. Authors' reprints presented to the Library are included in the list of articles.

A—Australian Geographer. AJ—Alpine Journal. A of G—Annals of the Association of American Geographers. A of Sc—The Advancement of Science. BAGF—Bulletin de l'Association de Géographes Français. BD—Berichte zur Deutschen Landeskunde. BE—Bulletin de la Société de Géographie d'Egypte. BG—Boletim Geografico. BHG—Bulletin de la Société des Professeurs d'Histoire et de Géographie. BIG—Bulletin of the Association of Indian Geographers. BRB—Brazilian Bulletin. CG—Czasopismo Geograficzne (Czechoslovakia). CGQ—Cahiers de Géographie de Quebec. D—Don (Sheffield University Geographical Society). EG—Economic Geography. F—Fennia. FKO—Földrajzi Közlemények (Hungary). FO—Focus. GA—Geografiska Annaler. GB—Geographical Bulletin, Ottawa. GJ—Geographical Journal. GR—Geographical Review. GRI—Geographical Review of India. GS—Geographical Studies. GSI—Geographical Society of Ireland (Irish Geography). GT—Geographisch Tijdschrift (Netherlands). IGJ—Indian Geographical Journal. J of G—Journal of Geography. JRCS—Journal of the Royal Commonwealth Society (formerly United Empire). MJTG—Journal of Tropical Geography. LG—La Géographie (Belgium). MO—Marine Observer. MW—Mitteilungen der Geographischen Gesellschaft Wien. NG—New Zealand Geographer. NGT—Norsk Geografisk Tidsskrift. NOB—Namn och Bygd (Norway). NSWR—New South Wales Bank Review. OG—Oriental Geographer. PG—Przeglad Geograficzny (Poland). PGA—Proceedings of the Geologists' Association. PMAS—Papers of the Michigan Academy of Science. RBG—Revista Brasileira de Geografia. RCG—Revue Canadienne de Géographie. REC—Revue pour l'étude des Calamités. RGA—Revue de Géographie Alpine. RGI—Revista Geografica Italiana. RGL—Revue de Géographie de Lyon. SAJ—South African Geographical Journal. SGA—Svensk Geografisk Årsbok. SGM—Scottish Geographical Magazine. SU—Survey (Univ. of Nottingham). T—Terra. UE—United Empire.

(E)—English summary. (G)—German summary. *—Maps.

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